Natural History Museum Library
000328400

1133.

15 JUL. 1907

1907.

VICTORIA.

DEPARTMENT OF MINES.

RECORDS

OF THE

GEOLOGICAL SURVEY OF VICTORIA

(E. J. DUNN, F.G.S., Director).

Vol. II., Part 1.

ISSUED BY

W. DICKSON, SECRETARY FOR MINES, UNDER THE AUTHORITY
OF THE HON. D. McLEOD, M.P., MINISTER OF MINES.

By Authority:
J. KEMP, ACTING GOVERNMENT PRINTER, MELBOURNE.

11120.—Price 2s. 6d.

29

1907.

VICTORIA.

DEPARTMENT OF MINES.

RECORDS

OF THE

GEOLOGICAL SURVEY OF VICTORIA

(E. J. DUNN, F.G.S., Director).

Vol. II., Part 1.

ISSUED BY

W. DICKSON, SECRETARY FOR MINES, UNDER THE AUTHORITY
OF THE HON. D McLEOD, M.P., MINISTER OF MINES.

BRITISH MUSEUM
G. D.
NATURAL HISTORY

By Authority:
J. KEMP, ACTING GOVERNMENT PRINTER, MELBOURNE.

11120.—Price 2s. 6d.

CONTENTS.

Page
Pre-Silurian Strata at Heathcote. E. J. Dunn, F.G.S. 1
Quartz Reefs near Woodend. E. J. Dunn, F.G.S. 1
The Golden Eagle Mine, Barnawartha. E. J. Dunn, F.G.S. 2
Some Gold Mines at Omeo. E. J. Dunn, F.G.S. 3
Some Gold Mines at Cassilis, near Omeo. E. J. Dunn, F.G.S. 3
The Discovery of the Ovens Gold-field in 1852. The Hon. David Reid .. 5
The Wedderburn Gold-field. E. J. Dunn, F.G.S. 6
The Daylesford Gold-field. E. J. Dunn, F.G.S. 10
Some Mines at South Kyneton. E. J. Dunn, F.G.S. 12
Iron Ore Deposits near Mirboo North, South Gippsland. J. W. Gregory, D.Sc., F.R.S., &c. 14
Ironstone near Mirboo North. E. J. Dunn, F.G.S. 16
Some Gold Mines at Maldon. E. J. Dunn, F.G.S. 17
The Charlotte Plains Deep Leads. E. J. Dunn, F.G.S. 20
Some Gold Mines at Egerton. E. J. Dunn, F.G.S. 23
The Morrison Gold-field. E. J. Dunn, F.G.S. 24
The Daylesford Mine and the Cornish Line of Reef, Daylesford. E. J. Dunn, F.G.S. 26
The Spring Hill and Central Leads Line, Jerusalem, near Allendale. E. J. Dunn, F.G.S. 28
The Occurrence of Quartz Spurs at Bendigo. E. J. Dunn, F.G.S. 30
The Berringa Gold-field. E. J. Dunn, F.G.S. 32
The Union Mine, Diamond Creek, near Melbourne. E. J. Dunn, F.G.S. .. 33
The Back Creek Silver-Lead Mine, near Buchan, Eastern Gippsland. E. J. Dunn, F.G.S. 35
The Glen Shiel Silver Lode, Gelantipy East, Eastern Gippsland. E. J. Dunn, F.G.S. 36
Proposed Reservation of Limestone Caves in the Buchan District, Eastern Gippsland. A. E. Kitson, F.G.S. 37
The Buchan Limestone, Eastern Gippsland. E. J. Dunn, F.G.S. 44
The Mount Tara Gold-field, Eastern Gippsland. E. J. Dunn, F.G.S. .. 46
The Dominion Copper Mine, near Buchan, Eastern Gippsland. E. J. Dunn, F.G.S. 47
The Iron Mask Ferro-Manganese Mine, near Buchan, Eastern Gippsland. E. J. Dunn, F.G.S. 48
The Good Hope Silver Mine, near Buchan. E. J. Dunn, F.G.S. 50
The Caledonia Gold Mine, Warrandyte, near Melbourne. E. J. Dunn, F.G.S. 50
The Cumberland and Phœnix Mine, Campbell's Creek, Castlemaine. E. J. Dunn, F.G.S. 51
The Spring Gully Mine, near Fryerstown. E. J. Dunn, F.G.S. 54
Some Gold Mines at Berringa. E. J. Dunn, F.G.S. 55
Some Gold Mines at Chiltern. E. J. Dunn, F.G.S. 57
The Golden Eagle Lode, Cookimburra, near Barnawartha. E. J. Dunn, F.G.S. 60
The Occurrence of Gold in Oliver's Paddock, near Kilmore. E. J. Dunn, F.G.S. 60
The Kilmore Gold Diggings. E. J. Dunn, F.G.S. 61
Gold Mining at Goldie, near Kilmore. E. J. Dunn, F.G.S. 62
Reports on Graptolites. T. S. Hall, M.A. 63
Newer Silurian Fossils of Eastern Victoria, Part I. Frederick Chapman, A.L.S., &c. 67

PLATES.
Locality Map, showing places mentioned in this publication.

PRE-SILURIAN STRATA AT HEATHCOTE.

(NO. 1 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey, Victoria.

I have the honour to report that I have met with a formation at Heathcote differing from any that has previously come under my observation in Victoria, and that appears to have hitherto escaped description.

The formation is of pre-Silurian age, and the beds of which it consists comprise highly siliceous and jaspideous rocks, very talcose splintery schists, tufaceous deposits, quartzite and ancient vesicular basalts—once surface flows, but now intercalated with other strata.

The railway cuttings near Heathcote expose a tongue of these rocks. They extend and widen out in a northerly direction towards Mounts Camel and Pleasant. How far they continue has yet to be determined, as I only discovered the formation on Saturday last, and traced it towards Mount Camel.

I have seen no rocks in Australia to correspond with those under notice, but they resemble in a marked manner a system of rocks that came under my notice near Auckland, New Zealand, on the islands Kawau and Waiheke. These same rocks continue through the Thames valley, and are known to New Zealand geologists as the Kaikoura or Te Anau series.

In New Zealand these beds are highly metalliferous, bearing gold, copper, manganese and iron, in profitable quantities.

It is very desirable that these rocks should be delimited, and at least a cursory examination made of them.

[*Report sent in 6th July, 1891.*]

QUARTZ REEFS NEAR WOODEND.

(NO. 2 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

EARLE AND CHRISTIE'S REEF.

The site is a little to the W. of S., 6 miles from Woodend, and S. of the Main Divide. It is about 1,800 feet above sea level, in thickly timbered country. The camp is on a small western gully, off Fletcher's Creek, which joins Gisborne Creek about three-quarters of a mile further to the south. The rocks are Ordovician sandstones and slates.

On the surface a reef-course is traceable by a ferruginous outcrop at intervals for nearly 20 chains. In the gully crossing the line of reef, several shallow holes have been sunk in the alluvial, and a little gold is reported, but not in payable quantities. On the northern side of this small gully, a shaft has been sunk in yellow and pink soft slates and sandstones to a depth of 60 feet. A very irregular mixture of country rock and quartz spurs that strike about N. and S., and dip to the W. is exposed. There are no well defined walls, but the broken country rock and quartz form a "mullocky" reef, ranging from 1 foot to 2 feet in width. At 50 feet a cross-cut has been driven west. It is horizontal for 24 feet, and then rises to an air shaft. The beds disclosed are soft slates and sandstones, dipping from 60 degrees to the W. to vertical. The strata are very much disturbed. The pitch is northerly. Near the bottom of the shaft are numerous spurs of quartz of small size.

Four chains W. of this line at the surface is a quartz-vein about 9 inches thick, carrying a little sulphide, but no gold has been got in it. At the surface, several tons of stone are bagged from the deep shaft, and samples from these showed gold when washed by the prospectors. Whether or not the reef here is a valuable one and contains sufficient gold to be profitably worked, has yet to be proved.

PAT. LYDDY'S REEF.

About ½ mile to the N.N.E. from Earle and Christie's reef, is a large outcrop of quartz, 4 to 5 feet thick, exposed for a length of 30 feet. It dips to the W. at 65 degrees, and appears to be the western leg of a saddle reef. The country looks like centre-country. On the eastern side of this a little work has been done. Still further to the N. are other outcrops of quartz, on some of which a little work has been done, but nothing is being done at present.

[*Report sent in 2nd November, 1904.*]

THE GOLDEN EAGLE MINE, BARNAWARTHA.

(NO. 3 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

The lease held is in Newson's Paddock, about 4 miles from Barnawartha township, and due S. from Mt. Cookimburra. The height above sea-level of the workings is about 1,000 feet. The rise from the main road to the workings is 100 feet. The excavations are situated on both sides of a small gully, running in a northerly direction. On the western side of the gully a shaft has been sunk 16 feet, and in it there is a vein of mixed quartz and granitic rock, from 5 to 12 inches thick. The country rock is composed of highly meamorphosed sedimentary beds. The vein-stone occurs in short blocks, and does not appear to be continuous; gold occurs in it in small particles. The stone ready for crushing is expected to yield 1 oz. to the ton, but no trial has yet been made. Sulphides occur in the quartz. On the eastern side of the gully, a hole has been sunk 11 feet deep. Here a fine-grained granitic rock, 6 feet wide, occurs, studded with white mica; it cuts through the mica-schist country. Through this granitic rock, arsenical pyrites is disseminated. A sample of this granitic rock sent to Dapto, N.S.W., is said to have yielded at the rate of 11 dwts. of gold per ton of stone.

So far, very little work has been done, and it has yet to be proved whether the vein-stone opened out is payably auriferous, or not. The interesting feature is the discovery of gold in these metamorphic rocks, of which there is a very large area, and to which attention is now attracted. It has always been a question whether the deep alluvial ground down the Indigo Valley was auriferous, or not. The discovery of gold in the metamorphic rocks drained by it renders it probable that the deep ground is auriferous. A wide field for prospecting is opened up in this district by Mr. Ashe's discovery.

[*Report sent in 10th March, 1905.*]

SOME GOLD MINES AT OMEO.

(NO. 4 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

THE GAMBETTA MINE.

About 4 miles westerly from the town of Omeo (about 1,800 feet above sea level) is the Gambetta Reef, in schistose rock, which gives place to a granitic rock near the southern end of the reef. The strike of the schist is W. 20 degrees N.; dip to southward, 60 degrees. The height above sea level is about 3,000 feet. The schist is very micaceous. The strike of the reef is to N. 15 degrees E.; the dip eastward at 75 degrees. Along this reef a level has been driven for about 1,000 feet, and the quartz has been taken out to the surface, but nothing has been done below. A shaft is now required if any further work is to be done. Judging by the manner in which the ground has been worked, it must have been rich in the higher levels. The quartz reef ranged from a few inches to 2 or 3 feet wide.

THE POLAR STAR MINE.

The Polar Star is a mine about 20 chains to the N.W. of the Gambetta. Here an expensive adit has been driven about 900 feet, I am informed, in very hard gneissose country, to try and pick up the continuation of a rich reef worked at higher levels. Nothing is being done here at present. For some distance in from the mouth of the adit, the rock was schist, then hard gneissose rocks was encountered.

About 300 yards W. of the Gambetta is the Thistle Reef, a new discovery, in schist rock, which is opening up well.

Several small reefs were formerly worked higher up the hill than the Gambetta. They are all deserted at present.

In all these small reefs, the quartz is but a few inches thick—in places only an inch or so—but it is rich enough to pay for working. Much sulphide of a complex nature occurs in the reefs.

These mines are in a neglected condition, and local capital is not forthcoming to open them out below the tunnels. Pumping and winding plant will be needed to work them. They well deserve a trial at lower levels.

[*Report sent in 10th March, 1905.*]

SOME GOLD MINES AT CASSILIS, NEAR OMEO.

(NO. 5 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

KING CASSILIS MINE.

The strike of the lode is a little E. of N.; the dip 62 degrees westward. Both the hanging-wall and the foot-wall of the lode are well marked. In width, the lode ranges from 3 feet to 8 feet. No. 1 level is about 2,100 feet above sea level. The shoots of ore pitch northward at about 60 degrees. The lode outcrops for about ½ mile. From the No. 1 level a considerable body of ore has been removed, and the present workings disclose a strong lode continuing under foot.

A lower adit is being driven to cut the lode. It has already been driven several hundred feet, but as this level is about 290 feet below No. 1 level, and the lode dips westerly, and also because the northern end of the lode appears to be faulted, accurate surveys are needed to locate the point at which the downward continuation of the lode might be cut. The lower level would give splendid backs, but it is not in the best position for economically conveying the ore to the recovery works. The adit should have been made in the same valley as the surface workings sc as to cut the lode in the middle, and thus give the cheapest transport for the ore from the whole lode. At present, the mine is working on a small scale only, but if the lode prove similar in the lower level to what it is in the upper one, large quantities of ore could be obtained. The ore is of the usual complex character of this district, and requires skilful treatment. The height of the lower level is about 1,800 feet above sea-level.

CASSILIS MINE.

This mine is reached by a road that branches off to the west from Tongio West. The recovery works are in the valley at about 1,650 feet above sea-level. The lodes are on top of the range, and are connected with the recovery plant by a self-acting tramway. The top of the tram-line is about 2,800 feet above sea-level. The cap of the lode on the top of the range is about 3,300 feet. Several distinct lodes exist on the lease, some of which have not yet been developed. From the eastward there are: The Eastern, Morning Star, Crisp, Blacksmith, Snake, New Find, and Cassilis lodes, seven altogether.

The lodes are found in schistose sedimentary country rock, which is probably Ordovician altered by the proximity of some granite mass. The ores are extremely complex sulphides. A fair recovery of the gold is obtained by cyanide, but it is quite a question whether this class of ore is not more suitable for the furnace. The classified concentrates are sent to Dapto, N.S.W., but the transport and other charges are very heavy. Quite a model plant is installed, and the work done is satisfactory, as a handsome profit is obtained.

From the cursory examination made, it appeared that the lodes are likely to prove permanent, and that in certain belts, they are numerous and fairly close together. The shoots of ore occur irregularly, so that to maintain a regular yield, it is essential that the developmental work should be pushed very far ahead of present requirements. The ore faces I saw were most favorable, and, although the ore is not as a rule very thick, it is so heavy that a large tonnage can be obtained from small veins.

The Cassilis is the pioneer mine of this district, and if it succeeds as it promises, the result will be the opening up of many lodes that on the surface yielded well, but which could not be worked in the sulphide zone. To Mr. Coote, the Manager, I am greatly indebted, as he enabled me to see much in a short space of time.

In the neighbourhood, there were other mines that deserved inspection, as some of them, such as the Warden, have produced large quantities of gold in the past, but time would not permit their examination.

[*Report sent in 10th March, 1905.*]

THE DISCOVERY OF THE OVENS GOLD-FIELD IN 1852.

(NO. 6 ON LOCALITY MAP.)

By the late Hon. David Reid.

I was at my station at Wooragee (afterwards known as Gemmel's station). In the evening, two young men came and asked to stay for the night. I got into conversation with them, and they mentioned that they had been with Mr. Smyth, surveying the mountains (Omeo country) on geodetic work, and that they had been discharged. They said to me, "This looks like gold country." I asked them whether they knew anything about gold, and they said they had been to California diggings, and that if they had the tools they would try that part of the country. I asked them what tools they wanted. They said a pick, a spade, a tin dish to prospect with, and some rations. I said, "For that matter, I will supply them myself." They had been conversing with my shepherd, a man named Howell, and had received information from him about the country; and shortly after our conversation Howell came to me and asked to be allowed to go with the two men. I said, "You can go for two or three days if your wife shepherds the sheep"; and this he and his wife agreed to do.

On the third day after they started, they discovered gold on the creek in front of the out-station hut, that stood where Beechworth now stands.

This hut was built of slabs, with bark roof, and stood near the creek on the west side of it, and just above the falls—just above the present bridge joining Beechworth and Newtoun. The three men sunk some shallow holes 2 to 3 feet deep on the edge of the creek, and washed the stuff on the rock in the dish. Howell returned and mentioned the matter to me. Then the news got about that gold was found in the creek, and men came from Albury and from Wangaratta. Among the first arrivals were John Fisher and William Wise from Albury, and Alexander Meldrum and Alexander Tone from Wangaratta. They sank alongside the first claims, and got good gold. Then a great rush set in, and men came from all parts.

REID'S CREEK.

The same two men, with Howell, when they saw what a rush had set in, and that thousands of men were arriving, set out with the object of prospecting afresh. I heard from Howell that they were working, however, down the same creek (Reid's Creek, known as such for many years before this, as our stations were on it). One day my brother John and myself were going round the stations, and I said, "Let us go up towards the falls, as Howell and his mates are prospecting about there, and we shall see what luck they have had." Accordingly, we made up the creek—Reid's Creek—from the wool-shed, and just above the junction of Rocky Creek and Woolshed Creek, we found Howell and his party. They saw us coming, and we saw them hastily put a pint pannikin under the bank of the creek. I said, "What luck have you had, Howell?" "Oh!" he said, "just middling," showing a small quantity of gold. "Oh!" I said, "that is all moonshine. What is that you've got under the bank?" They laughed. "Out with it," I said, "and let us have a look at it." They brought it out, and there was a pannikin nearly filled with gold, almost 14 lbs. weight, roughly. They had only been there a few days. They begged me to say nothing about it, but it soon leaked out, and a rush set in. Reid's Creek was discovered about three or four weeks after Spring Creek was opened. Both Wise and Fisher got a good deal of gold on Spring Creek. At Reid's Creek, I was buying gold soon after it was opened up, and gave £2 16s. per ounce for it. Brown's party consisted of four men, named Brown, Maidment, Gaire, and Old Jack. I bought as much as 70 lbs. weight of gold from them—one week's working in 9 feet sinking. One day Brown came into the small store I kept, carrying a prospecting dish on his head, covered with a cloth. I said, "What have you got there?" He answered, "A little gold," and there were 70 lbs. weight in the dish. This party took away £49,000 in hard cash, after two months' work. The old hut where my store stood was an out-station at the junction of Rocky Creek and the Woolshed Creek.

About three months after this a man named Carrol, discovered gold at Yackandandah, which is the original blacks' name for that place. I brought Carrol up from Goulburn, and I also brought up, from Sydney, Johnson (afterwards known as the "Woolshed Boss"), who was the first discoverer of gold on Woolshed Creek. The run through which Reid's Creek flows was taken up in 1838. In 1845, or the beginning of 1846, I commenced the flour-mill, long known as Reid's Mill. We were cutting a race to bring water to the wheel. One day we were examining the stuff being dug out, and I took up a bit, and said, "This looks like gold." Afterwards gold was discovered in California in a similar way. Later on, the ground around Reid's Mill was worked for gold, so that I actually found gold before its discovery in California, by Sutor in his mill race.

[*Report sent in 3rd April*, 1905.]

[This report is by the late Hon. David Reid, of "Moorwatha," Howlong, N.S.W. Mr. Reid arrived in Sydney in 1823, and was among the first pioneers to bring stock into Victoria in 1837. He was 85 years of age when he furnished this report. I regret to say he has recently died.—E. J. D.]

THE WEDDERBURN GOLD-FIELD.

(NO. 7 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

At Wedderburn the salient features of the topography are a series of low ridges and spurs, separated by broad shallow gullies and alluvial flats. The surface of these spurs and ridges is strewn with fragments of quartz and ironstone. It is a prominent feature that quartz is present in unusual abundance. About 1¼ miles west of the town is a strong outcrop of this mineral. Great masses rise 12 to 14 feet above the surface; but, as a rule, the quartz occurs as fragments but so abundantly in places that the surface is nearly white.

Another feature that attracts attention is that, within the best zone for gold, which extends for a width of about 2 miles from Wedderburn in a westerly direction, and runs about N. 7 deg. W., the soil is of a deep-red colour. Mallee vegetation covers a great deal of the surface; larger varieties of eucalypts grow in belts and patches.

Where the underlying rocks are exposed in railway cuttings and in shafts, &c., the rocks are seen to belong to the Ordovician series. They consist of red, yellow, grey, and white soft beds of sandstones and slates, much decomposed and very friable. These are frequently seamed by veins of ironstone and quartz. Very fine white clay (pipeclay) occurs abundantly, and generally to a depth of 100 feet. These rocks can be sunk into with the pick and shovel alone.

In their aspect these rocks typify the beds that are productive of gold in this State. The rocks are soft, and the surface is consequently rounded off in smooth contours. The beds are highly coloured by iron oxides, and stained in a manner that gives the clue to the formation of nodules in solid beds of rock. The sandstones, mudstones, and slate are often covered, where exposed to the air, with a magnesian salt (probably sulphate of magnesia) as an efflorescence. On account of the facility with which it deliquesces, the sandstones at the surface commonly fret away quickly, and the slates underground are commonly covered with a thick coating of capillary crystals. All the features of the auriferous zones of Ordovician and Silurian strata are very well developed in the unaltered Ordovician rocks of Wedderburn, and to some extent also in the metamorphic rocks.

To the east of Wedderburn the rocks are metamorphic—highly micaceous schists, &c.—the alteration due, no doubt, to contact with the underlying granitic rocks which outcrop at intervals on the flat east of the town. The altered portion of the Ordovician rocks, stretching N., W. and S. from the Torpichen pre-emptive right, have proved auriferous, both alluvial and reef having been worked there. The belt of rocks westward from Wedderburn presents unusually favorable appearances for gold, and the manner in which the flats and gullies have been torn up by alluvial workings proves that the appearances are not illusory. Prominent characteristics of the alluvial gold were its coarseness and the patchy manner in which it was distributed.

Reef mining has not been developed in a manner at all commensurate with the alluvial workings. There are few shafts exceeding 100 feet in depth, and the reason for this appears to be that this gold-field lies within the great indicator area that forms the heart of the principal gold-bearing tract of the State, a tract extending from 8 to 10 miles north of Wedderburn, southward to Meredith and Steiglitz, and from Newbridge on the E. to Stuart Mill on the W. Reefs that appear to have the characteristics of saddle country do occur, such as the Jubilee and Specimen Hill reefs, about a mile N.W. from the town; but these are exceptional. Indicators are the rule, and they appear to be developed to an unusual extent, and in a manner that does not appear to have been grasped by the miners, so far. If once this is made clear, it should result in a complete resuscitation of the gold-field, and, instead of fewer than 20 miners being at work, hundreds should find profitable employment. The indicators at Wedderburn are beds, some of extreme thinness, and up to 2 feet thick, or more. Where quartz veins intersect them gold occurs. The whole country is veined with quartz, and once any of the indicators is met with it could not be followed far without encountering a quartz vein. As the indicators are beds, they are easily followed, and miners soon become expert in tracing them for long distances.

Although indicators have long been recognised as a feature of this field, their relations to the anticlinal lines do not appear to have been recognised.

As at Bendigo, the structure of the rocks here is that they are bent into a series of anticlinal and synclinal folds—corrugated, in fact. At Wedderburn the folds recur at shorter intervals than at Bendigo. These anticlines are exposed in the cutting at the railway station; in a length of about 200 yards five anticlines occur. A feature in which they differ from the Bendigo folds is that the beds are not so regularly arched, but are sharply bent and ruptured. Along these anticlines the rocks are much shattered, and quartz, as spurs irregularly crossing the beds, is abundant.

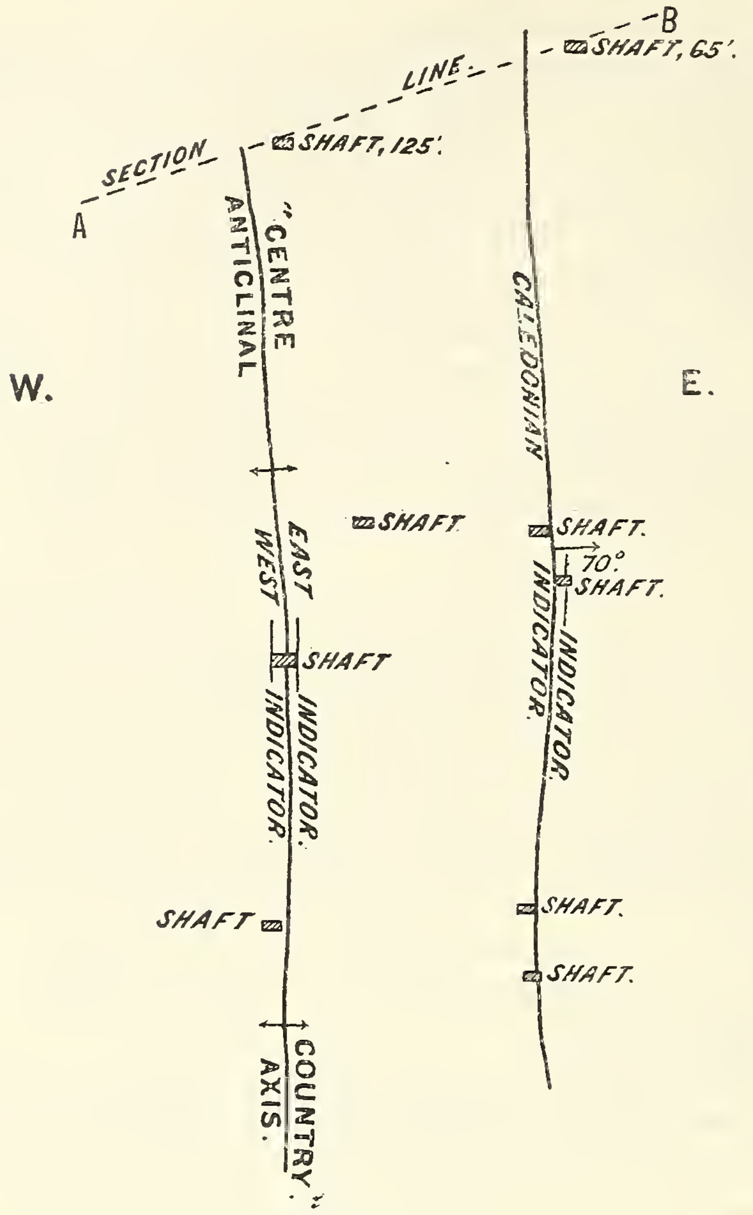


Fig. 1.

Plan of Part of Brockwell and Grigson's Claim.

In relation to the indicators, these anticlines are of great value, for where a set of quartz veins has been found to carry gold along the course of, say, an easterly indicator, the continuation of the same indicator should be searched for on the W. side of the anticline, or centre-country, for the indicators, being beds, are bent over with the other beds, and the importance of these relations will be seen by the attached plan and section of Brockwell and Grigson's claim. In this case the Caledonian indicator has been worked on the E. side of the anticline for several hundred feet in length, and down to from 45 to 60 feet from the surface, where it was cut off by a fault dipping N.W. The owners of the claim have worked on this E. indicator for some distance, and now have a shaft sunk to a depth of 125 feet. They have cut this same indicator in the bottom, but they were unaware of the proximity of centre-country, and did not know that the indicators should recur to the W. of the centre-country.

There are already three indicators proved on the E. side of centre-country. One is in a shallow shaft, a little S. of this deep shaft, where the indicator is about 3 feet E. of the axial line; the second is the Caledonian indicator, 90 feet E. of centre-country; 6 feet further E. is the third indicator. But this country has never been systematically prospected for indicators. When it is there is reasonable prospect of proving a succession of them, such as occur in the Ballarat East mines.

This gold-field requires a careful detailed survey as part of any plan to minutely survey and elucidate the rock structure of the whole tract of country embracing all the principal western gold-fields; for there is no geological work that can be performed in the State which will so directly tend to assist the advancement of the mining industry.

It is intended to locate a survey party on the Wedderburn gold-field during the coming winter.

Mr. Oliver Grey rendered good service in pointing out to me the interesting features of the localities visited.

EXPLANATION OF PLAN AND SECTION OF PART OF BROCKWELL AND GRIGSON'S CLAIM, WEDDERBURN.

The plan shows centre-country (the anticline) which is well marked on the surface, and traceable for a much longer distance than appears on the plan. Two "indicators" are shown close to centre-country, one to the east and the other to the west; this, in fact, is the same bed of slate bent over the axial line. Further to the east the Caledonian "indicator" is shown. This indicator, another bed of slate 2 inches thick, has been extensively worked. It has been followed along its course for some hundreds of feet, and was worked down to a depth of from 40 to 65 feet,

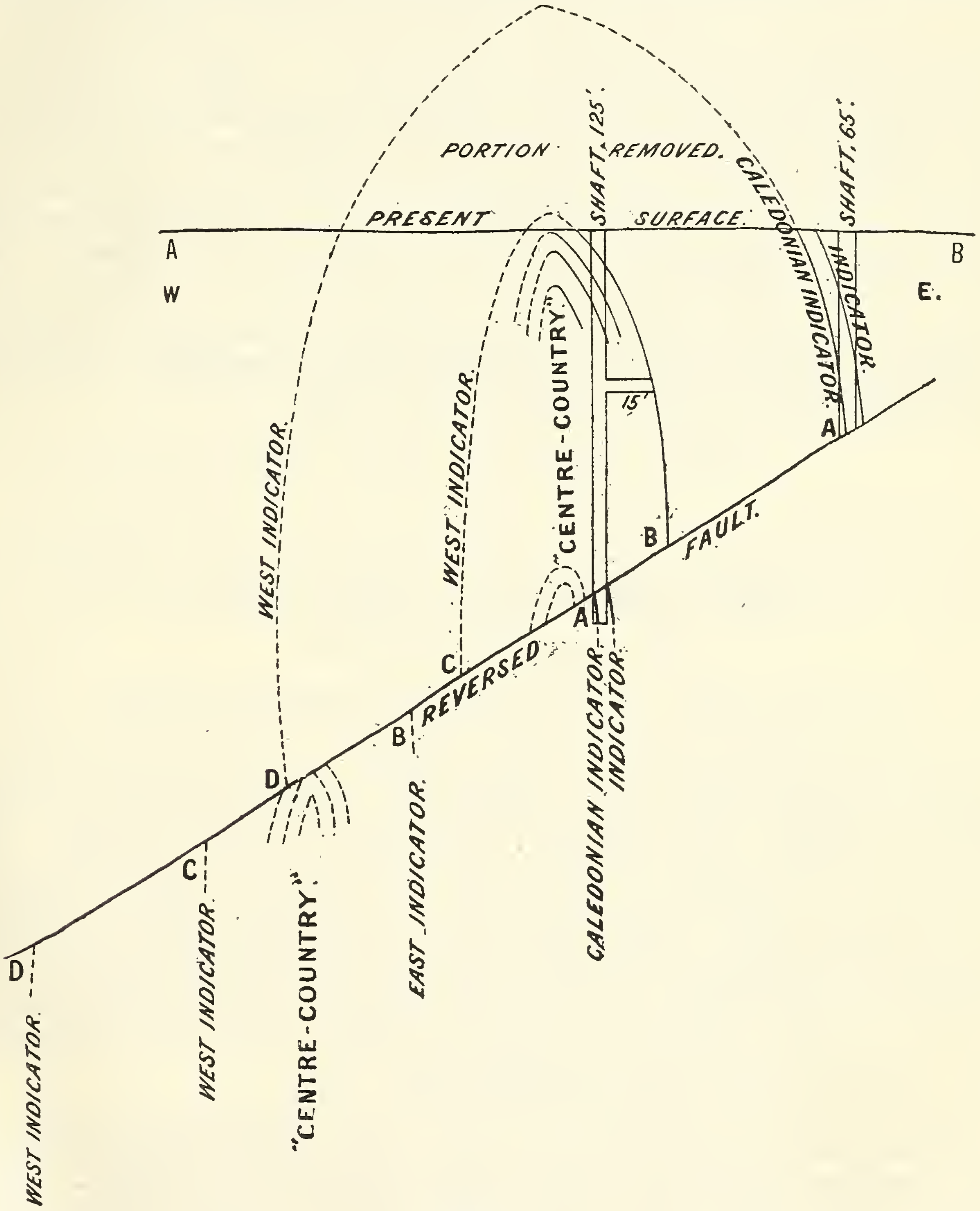


FIG. 2.

Section along A B in Fig. 1.

until the fault that underlies it, and that cuts everything off, was reached. Where this indicator was intersected by quartz spurs that are of later origin than the indicators, gold was found, and in places the quartz was rich in gold. As this is an eastern "indicator," and a bed running with the other beds, the continuation of it must recur at the same distance to the west of centre-country as the Caledonian is to the east of centre-country, as shown in the section. To the north of the portion shown on the plan the Caledonian indicator widens out from centre-country, and also southward, which implies a southerly pitch for the northern part and a northerly pitch for the southern part.

The shaft, 125 feet deep, is well placed for working the continuation of the Caledonian indicator above the fault, but not well placed for working the series of indicators below the fault. For this purpose it should be 90 feet further to the west.

The section through the deepest shaft, and the site of the present workings, has what the owners state is the Caledonian indicator in the bottom. They have worked this indicator for some distance below the fault, and should be in a position to recognise it. Accepting this as the Caledonian indicator, the section represents the "indicator" near to and on the eastern side of centre-country, which has been located as shown, and a little work done on it. It also shows the Caledonian eastern indicator, as worked down to the fault, and another small indicator that occurs 6 feet further to the east than the Caledonian. No work has been done except on the eastern "indicators," so that the position of the western "indicators" is approximate only. The section will serve to show the great resources in gold of the Wedderburn gold-field, and how little has yet been done to develop them; for, wherever these "indicators" are cut by quartz veins, there is a chance of gold being found.

[*Report sent in 31st March*, 1905.]

THE DAYLESFORD GOLD-FIELD.

(NO. 8 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

At Daylesford the stratified rocks consist of sandstones, slates, and mudstones of Ordovician age. These are covered over in a sporadic manner by basaltic flows, and there are several points of eruption within a few miles of the town. Judging by the appearance of the stratified rocks where they are exposed in cuttings, &c., they appear mostly to belong to the Castlemaine zone. When altered by surface action they do not show the brilliant red, yellow, and other tints that are characteristic of the No. 1 zone of Bendigo. They are generally greyish, or of pale yellow, or pink tints, and the soil derived from them is either grey or of yellowish-grey colour. Some belong to the Bendigo zone.

Fossils (graptolites) obtained by Mr. W. H. Ferguson from the Victoria Cornish mine are recognised by Mr. T. S. Hall, M.A., as identical with graptolites that occur in the upper portion of the No. 1 zone of Bendigo. The fossils were found on the waste tip from the engine-shaft, and are probably from the bottom cross-cut, 966 feet from the surface, and therefore, perhaps, in the upper beds of No. 1 zone on the anticline.

In structure this country resembles Bendigo as regards the succession of anticlinal and synclinal folds; but at Daylesford the folds appear to be much closer together. In some cases the interval between the anticlines does not exceed 200 feet. There appear to be some main folds corresponding with the New Chum, Hustlers', and Garden Gully lines at Bendigo, with minor folds that correspond with the "sides lines" at Bendigo. Mining operations should be carried on as far as possible along the main folds.

One main anticline is exposed behind the stable near the quartz mill of the Victoria Cornish mine, where the arch is clearly shown. It runs beneath the small magazines, and is exposed in a cutting to the west of the engine-shaft mullock heap. It runs through the mullock heap, and is exposed in the western side of a small gully further to the east. It passes half a chain to the west of the old round brick stack, and in the deep gully to the east it is exposed on the eastern side, where a large mass of quartz projects some feet above the surface. Then it passes to the east of the shaft of the South Victoria Cornish mine, and eastward to the gate-house on the railway. On the eastern side of the railway it is covered up by basaltic rock.

Lines of anticline, or "centre-country," are very numerous, and well shown in many places. East of the public park, Wombat Creek is confined between narrow banks, and just below, in the creek bed, an anticline is well shown. Near this would be a favorable site for a shaft. Between this site and the public park a large body of quartz is exposed, and, alongside, the quartz spurs have been worked at the surface. Another anticline is exposed here, and still another nearer the park, close to a small dam.

From the appearance of these surface beds, and the horizon they occupy, as shown by the graptolites obtained here, it is fairly certain that they are higher up in the series than the No. 1 zone at Bendigo, and that the probabilities are that, by working at greater depths the rocks will be found more productive of gold.

A great deal of alluvial mining has been done at Daylesford, and many leads have been worked under the basalt. Rich returns were obtained from some of the workings, and, judging by their extent, it appears that a belt, of over three miles in width, of these Ordovician rocks, is auriferous.

Quartz mining has been carried on from a very early stage of this gold-field, and with very profitable results in some cases. The Cornish group of mines, though only worked to a few hundred feet in depth, gave a heavy yield of gold, but mining languished, and became almost defunct. Within the last three years, however, this industry has been revived, and some of the old mines are being worked in a spirited manner, and with excellent results. There is a very extensive area of country around Daylesford that offers great inducement for quartz mining, and all the aspects seem to indicate that, as depth is attained, the conditions improve for increased richness in gold of the quartz veins.

VICTORIA CORNISH MINE.

In the Victoria Cornish mine, which is the Cornish mine revived, there are three transverse quartz lodes that appear to conform generally to the strike of the beds, but differ in dip, the lodes dipping west, while the beds dip east. These lodes fill fissures that are well represented at Bendigo, when faults of a certain class coincide with the bedding planes on the west side of a syncline, then cross the country in a direction opposite to the beds to the anticline, and then follow down between the bedding planes on the east side of the anticline. Whether the Daylesford series is formed in faults of this class can only be determined when they are traced to centre-country or anticlines. It appears that when these lodes traversed certain beds the quartz was auriferous to a profitable extent, but that when they traversed other beds the quartz was practically barren. The names of these three lodes from the eastward are:—The Queen, the Cornish and Colliers. As centre-country occurs about 200 feet from the shaft at the 966 feet level, and the Cornish lode is being worked towards it, there should be no great difficulty in proving how the lode is influenced when centre-country is reached. The engine shaft is well placed as regards centre-country, if it makes eastward in depth, as at Bendigo. The shaft is favorably situated also as regards pitch, for the pitch is southward, and therefore deeper beds will be cut at the present shaft with less sinking than would be cut at the south end of the lease.

Besides the three transverse lodes in the Victoria Cornish mine there are also spurs. A body of these spurs, about 20 feet wide and 11 feet high, pitching southward with the beds, is now being worked, and is giving good returns. Coarse specks of gold are visible in these spurs. The country rock in which they have formed is slate and a coarse description of slate approaching a fine sandstone in character. A fracture runs to the east from the channel of the Cornish lode, and cuts through the beds in a south-eastern direction. There has been some movement, for along this fissure a little clayey material (pug of the miners) is formed. The auriferous spurs are all east of this fissure, or slight fault, and this is the guide in keeping on the gold. Such bodies of spurs have been largely worked in this mine, and have proved very profitable. Extensive prospecting and extreme vigilance are necessary in such a mine to make sure that such valuable spurry bodies are not missed.

To help forward the mining industry at Daylesford it is very necessary that on the detailed geological sheets already published the direction and courses of the anticlines (centre-country), should be laid down.

The mineral springs for which this district is famous are an asset that might be turned to better account. Those coming out in the bed of the creek below the large hotel building are in the Ordovician rocks, and one of them is on an anticline.

To Mr. Field, general manager of the Victoria Cornish mine, and to Mr. Day, the mine manager, I am indebted for much courtesy and for facilities in examining that mine.

[*Report sent in 19th April, 1905.*]

SOME GOLD MINES AT SOUTH KYNETON.

(NO. 9 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

Coliban Reef.

About two and a half miles south of Kyneton, on the road side in private property, is the Coliban reef. Two shallow shafts have been sunk on it, and there are some surface trenches. The surface is strewn with quartz; soft sandstones and slates are exposed in the excavations. Several crushings are said to have been taken out, but no returns are available. This site deserves to be further prospected.

CECIL RHODES MINE.

In a south-westerly direction from the Coliban Reef, and about four miles from Kyneton, is the Cecil Rhodes mine, now being worked by Messrs. Eadie Bros., and on which is a small oil engine, driving five stamps. This shaft is down 100 feet. At the surface a mass of quartz 6 feet thick was exposed. From the surface this was worked by a company, and 34 tons of ore taken out yielded 147 ozs. 12 dwts. of gold. The country rocks consist of soft and friable slates and sandstones of greyish colour, dipping easterly. The quartz body cuts through these beds in a westerly direction. There does not appear to be a well defined reef, but large masses of "spurry" quartz, about 50 feet in length, have been worked between the surface and the 100 feet level, but not the whole taken out. The present owners state that nearly £2,000 worth of gold has been obtained altogether. There are outcrops of quartz extending in a southerly direction, and a shaft has been sunk at the junction of the Tylden and Kyneton roads. From this point, a well marked quartz reef extends N.W. for a long distance, but beyond surface prospects nothing has been done to test it.

HARDY'S FREEHOLD MINE.

About half a mile N.W. from the Cecil Rhodes mine is Hardy's Freehold shaft, 150 feet deep. Considerable work has been done here, and quartz, with much mixed sulphide, is strewn about near the shaft. Antimony occurred in large amount in this reef. Some payable results are said to have been obtained, but no records are available. Nothing has been done here for many years.

LORD BOBS MINE.

About 600 yard east of the Hardy's Freehold mine is the Lord Bobs mine. The shaft is 75 feet deep. The reef is said to be 2 or 3 feet thick, and to have been worked to a depth of 50 feet. The quartz is said to have yielded from 4 to 9 dwts. of gold per ton, and the last crushing is reputed to have given 4½ dwts. per ton, but the heavy charges for cartage and crushing rendered the working unprofitable.

TREASURE TROVE MINE.

Five hundred yards westerly from the Hardy's Freehold mine is the Treasure Trove. From a depth of 20 feet, 40 tons of quartz are reported to have given 2 ozs. per ton. Subsequently a company sank a shaft 130 feet deep, and then ceased operations. Four chains north of the Treasure Trove mine a ridge of quartz, about ½-chain across, runs in a N.W. direction for about ¼ mile. On the S. side of this a tunnel has been driven, intersecting this large quartz body, but as nothing further has been done, the stone appears to be of little or no value.

The above occurrences are all on private property. The quartz veins generally occur crossing the beds, and do not appear to be well defined bodies, still the profitable work carried on at the Cecil Rhodes mine renders it desirable that more work should be done on the other areas that have been proved auriferous.

Mr. Kerr, of Kyneton, accompanied me, and I am indebted to him for the names of the several mines, and for the particulars about the yields.

[*Report sent in 11th May, 1905.*]

IRON ORE DEPOSITS NEAR MIRBOO NORTH, SOUTHERN GIPPSLAND.

(NO. 10 ON LOCALITY MAP.)

By Professor J. W. Gregory, D.Sc., F.R.S., &c., late Director, Geological Survey of Victoria.

Recently I visited Mirboo North, and examined the iron ore deposits found near there.

THE ORE.

A sample of the ore was recently analyzed at the Mines Department Laboratory, and Mr. P. G. W. Bayly reported its composition as follows:—

	Per cent.
Silica	2.75
Titanic oxide	1.00
Ferric oxide	77.14
Ferrous oxide	1.80
Alumina	3.70
Lime	nil
Magnesia	nil
Sulphur	.07
Phosphorus	.01
Water (at 100 deg. C.)	2.22
Water (ignition)	11.30
	99.99

This analysis is very favorable, as it closely agrees with the standard of American Bessemer ores, and is indeed slightly better than the average of them, being lower in phosphorus. The American standard for Bessemer ore is:—

	Per cent.
Iron	63
Water	10
Phosphorus	.045

GENERAL GEOLOGY OF THE AREA.

The ore deposit may, therefore, be regarded as including excellent material, but its value depends on the quantity, and the chances of its successful exploitation. The deposit occurs in the allotment of Mr. H. J. Funston, No. 98, parish of Allambee East, three miles, in a straight line, N. 7 deg. W. of Mirboo North. It is a little to the east of Lydiard's track, at the approximate height of 1,200 feet above sea level.

The geology of this area is somewhat complex, the various rocks having been disturbed by a series of powerful faults; and the task of unravelling the knot into which these disturbances have tied the beds is rendered difficult by the thick cover of forest. The foundation of this district is the thick mass of Jurassic sandstones, known as the Victorian Coal Measures, because in some districts of Victoria they enclose coal seams. Above the sandstones is a series of much more recent deposits, including some quartzites, clays, and brown coals; above them occur in places, sheets of basalt and volcanic deposits, now mostly decomposed; and above this formation is a still later series of deposits, including gravels, sands and ironstone conglomerates, and, most noticeable of all, are thick beds of mottled, many-coloured clays.

At one time, each of the beds of these four series was widespread as a continuous sheet; and the more recent beds were probably all at a higher level than the underlying Jurassic sandstones. But by a great series of faults the continuity of the sheets has been broken; great bands of the upper beds have been dropped to a lower level till they form the floors of the valleys, which are of the type of rift valleys. The recognition of these faults is essential to anv understanding of the geology of this area, and to any attempt to determine the range of its coal and mineral deposits.

The best general account of the geologv of this area is by J. H. Wright (Prog. Rep. Geol. Surv., Vict., No. VIII.), who has described many of the chief faults.

Economic Geology.

The two chief economic products of this area are coal and iron. Scarlett's seam of black coal is onlv a few miles south of Mirboo North, and the presence of coal in many of the creeks of this districts is widely reported. But no coal is being worked, and I did not see any of the Coal Measure rocks between Mirboo North and the iron deposit.

Iron is widely distributed in the district. I examined two outcrops. One at Mr. Gilfeddar's paddock, just east of the eastern boundary of the township of Mirboo North. There are some concretionary masses of limonite, overlying mottled clays. The masses are associated with boulders of ferruginous quartzose conglomerates, which outcrop for a few chains on the hill side. But there is no evidence of any outcrop of ore on a commercial scale.

The second outcrop is that on Funston's paddock, and is held bv the Mirboo Coal and Iron Syndicate. The ore is exposed by a landslip, on a steep hill slope, down to one of the tributaries of the Little Morwell River. The rocks exposed on the hill slope are mainly the mottled clays of the uppermost series. They are repeated at various levels by landslips. The limonite occurs below the ordinary mottled clay, and above the larger ochreous clay. Apparently below it is a bed of fine-grained quartzose, ferruginous conglomerate. At the foot of the hill, in the creek, are two shafts, which I was told were dug by Mr. J. H. Wright in search of coal. No undoubted coal measures are now exposed, though some decomposed shales may belong to them. I was told that the coal measures are exposed in the next creek to the north, where a seam of coal is said to occur in them.

The limonite is in concretionary masses in the mottled clay series; the amount exposed is too small to be of practical use. There is no sign of any lode, or any prospect of the occurrence of a lode. The adjacent rocks are stained with iron, and, as not infrequently occurs in such conditions, the percolation of water through the rocks has caused the concentration of some of the iron into nodular masses. The prospects of the occurrence of ores in sufficient quantitv for working depends on whether the limonite forms a widespread bed, or occurs in small patches where the drainage escaped on the surface in springs. If the ore is in a widespread bed, it should be easily found by searching along the hill side, both north and south of the outcrop, and also on the western slope down from Lydiard's track. A cut back into the hill, at the outcrop, would probably suffice to show whether the ore is in a thick regular bed or in irregular patches. Hence I should advise the syndicate, before proceeding further, to dig back into the hill, at the point where the ore is exposed, and also to search the cleared ground along the hill slopes, to the north and south, for any continuation of the ore.

The Economic Value of the Deposit.

The syndicate no doubt realizes that there will be no chance of working the deposit unless the amount of ore that can be cheaply won is very large, and there is little prospect of iron smelting being undertaken in Australia until the Federal Parliament has settled the conditions under which the industry is to work. Even if the proposed bonus of 10s. a ton be granted, there is no chance of success unless the attempt be made under the most favorable conditions, with abundant, easily-obtained ore, cheap fuel, and a convenient, accessible site, and expert management. An eminent English expert recently reported that to secure an annual output of 150,000 tons of iron, the capital that would be required would be well over £1,000,000. And Mr. Jenkins (late Government Metallurgist) estimated that a blast furnace, that would smelt 500 tons of ore a week, would cost about £12,000.

The ore at Funston's is in a somewhat inaccessible position, and it is no use considering the heavy cost of iron smelting works until a much larger amount of ore is proved than there is any evidence for at present. The ore is good, but the amount in sight is small, and its form suggests a "patchy" development. It is certainly worth while determining the extent of the deposit, although it may be found advisable to postpone any attempt to work it until the difficulties in the establishment of an Australian iron industry have been overcome at some locality where the conditions are more favorable and the amount of ore is free from doubt.

[*Report sent in 5th August, 1903.*]

IRONSTONE NEAR MIRBOO NORTH.

(NO. 10 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

This deposit is about 3 miles in a northerly direction from Mirboo North, and about 350 feet higher than the railway station, or 1,134 feet above sea level. Where the ironstone (limonite) occurs a series of landslips have taken place, and in this manner the iron ore is well exposed. At this locality the rocks consist of a highly ferruginous Cainozoic (Tertiary) grit below, with mottled clay above.

Through the clay a great deal of ferruginous material is disseminated. The clay appears to be a decomposed volcanic ash. The limonite in part has segregated into solid masses, and the process can be seen in all its stages from where the iron is disseminated and not in any way forming separate material, to where large masses of pure limonite have separated from the mass. In places the iron ore is partly separated, but the process has not proceeded far enough to form a compact hard ore; in other places the limonite is very hard and compact, and forms a rich ore.

Although the whole of this clay for miles around is highly ferruginous, it appears that only over certain areas has the segregatory action taken place by which the iron ore has accreted, and over large areas none worth mentioning exists. Underneath the ferruginous clay, which varies widely in thickness, is a coarse Cainozoic grit, also highly ferruginous in places, and this iron oxide has doubtless been derived from the overlying clay.

Both Professor Gregory and Mr. Jenkins have written detailed reports on this occurrence, and dealt exhaustively with the subject. There is little to add to their reports. As iron ore deposits they could not be worked to advantage at the present time; but it appears that samples of these iron ores sent for assay have given remarkable results, and raised hopes that, though not of value as iron ore, they might be worked for the gold they contain. The results obtained vary widely, and to settle this point samples were secured personally, and these have been assayed with special precautions, at the Mines Department Laboratory, by Mr. P. G. W. Bayly personally, wth the following results:—

Sample of limonite from the principal exposures, about 3 miles northerly from Mirboo North (Funston's Allotment).—Assay gave—Gold, a trace; silver, nil. Sample of quartz grit, ½ mile north-east from above—Assay gave—Gold, a trace; silver, nil. The trace of gold was, in each case, only detected by the combination of a large number of assays, and was very minute. Other assays, shown to me, were as under:—Mirboo North, iron ore (limonite).

Assays.

School of Mines, Ballarat—

Limonite, gold, 15 grs. per ton.

School of Mines, Bairnsdale—

20 lbs. sample of limonite.
Metallic iron, 51.3 per cent.
Gold, 8 dwts. 9 grs. per ton.
Silver, 4 dwts. 0 grs. per ton.

School of Mines, Bairnsdale—

Bulk sample of 1 ton 8 cwts. 2 qrs. 6 lbs.
Gold, 6 dwts. 2 grs. per ton.
Silver, 9 grs. per ton.
Gold left in residue, 9 grains.
Metallic iron, 47.6 per cent.

Assays made of a sample collected by Professor Gregory showed no trace of gold. The samples collected by me confirm this, and I have no hesitation in saying that the iron ore outcrops examined by me are barren of gold and silver, except for a mere trace of gold.

[*Report sent in 25th May, 1905.*]

SOME GOLD MINES AT MALDON.

(NO. 11 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

During a short visit to this interesting and productive gold-field, some of the mines were descended, and salient features noted.

The South German Mine.

This mine has the deepest shaft on the field, 2,000 feet to the bottom, where a plat is cut, but nothing more has been done. For many years this mine was one of the most regular gold producers, as a shoot of auriferous quartz extended down from the 430-feet level, and from this steady yields were obtained that insured dividends for many years. A fault cut off this productive shoot, and since then prospecting work has been carried on from level to level, but without much success so far. The shoot of good quartz only occupied a short length of the channel—about 13 feet.

The channel, or course of the lode, appears to cut at a small angle across the strike of the strata, which consist of schists (altered Ordovician rocks). The dip of the rocks is easterly, and the pitch of the rocks and of the auriferous quartz is north-easterly. Another channel parallel to the main one runs 300 feet to the west of the shaft.

At the 1,750-feet level a cross-cut is in 150 feet east of shaft. The level extends 950 feet north of the cross-cut. At 725 feet on this level the reef is cut off by a fault. A rise in the fault shows a large quartz reef. At 2,100 feet is a cross-cut to the east, 183 feet; level to the north, 430 feet. There is abundance of quartz all along the level. At the north face, about 5 feet of quartz is exposed. It appears to be of a favorable nature. In the lower levels of this mine quartz occurs in great abundance, but, so far, not rich enough in gold to be worked profitably. Besides, the ample field at lower depths that remains to be explored, there are other points in the mine that deserve to be prospected.

Northward of the main shaft extremely rich auriferous quartz was obtained at the surface and at shallow depths, about 40 years ago; but nothing appears to have been done towards tracing this downwards. Probably faults cut off the gold in the old workings, and nothing further has been attempted in the way of recovering the lost quartz reef. There is ample room for a rich shoot of gold in this direction.

Southward from the main shaft, the continuance of the shoot worked so successfully does not appear to have been sought for near the surface. From the bottom level, a level driven southward along the channel would explore country so far unknown. Between the present depth and the surface there is a vast amount of prospecting work required, while below that depth the mine is untouched.

THE NORTH BRITISH MINE.

This mine was formerly known as Parkin's Reef, and now is one of Mr. Oswald's private mines. The shaft is 1,250 feet deep.

The Main Reef in this mine appears to cross the bedding of the country rock (hornstone) in the upper levels, and to conform to the bedding in the bottom levels. The Spur Reef conforms with the strike and dip of the strata, and is therefore a "leg." Coon's Reef, at the 900-feet level, also appears to be a "leg," conforming in dip and strike with the country, and apparently forming the western leg, Rodda's Reef being the eastern leg. The saddle reef joining these two reefs was worked, and it pitches northward. Mr. Moon is distinct about this being a true saddle reef, but the writer had not enough opportunity to feel confident on the matter. The remarkable keel-like ridge that this reef reposed upon certainly looks like centre-country, but the metamorphism appears to have obliterated the characteristic structure that is generally observable at centre-country. The Spur Reef was worked profitably from the surface to between the 500-feet and 600-feet levels, where a fault cut it off, throwing the reef to the west. It was recovered above the 600-feet level, and worked profitably down to the 700-feet level, when another fault, dipping to the west, cut the roof off again. The continuation has not been recovered. At the 700-feet level, and 830 feet south of the shaft, and 330 feet to the east from the level, the fault occurs. A winze is being sunk below the 700-feet level, and at 45 feet the fault was cut. The strike of the fault is N. 20 deg. E., and dip 55 deg. W. It is doubtful if the 800-feet and 900-feet levels have been extended far enough east to pick up the Spur Reef. At the 900-feet level, 880 feet to south of the shaft and 240 feet to east of the level, another fault, dipping westerly, is met with.

Payable quartz has been mined from different parts of the Main Reef, but the Spur Reef was uniformly profitable to work, and the recovery of the lost reef is now engaging the attention of the manager .

There are very large bodies of quartz in this mine, and excellent returns have been obtained in the past. The depth so far attained is but a moderate one, and there appears no reason why, as development goes on, this should not prove as profitable to work in the future as in the past. There is probably a long life before it. The rare mineral, maldonite (Au_2Bi), has been found more abundantly at this mine than elsewhere.

THE EAGLEHAWK CONSOLIDATED MINE.

The depth of the shaft is 1,250 feet. The country rock all dips east, the pitch of the country is south, and the pitch of the quartz and gold also southerly. At the No. 10 level, 1,150 feet from the surface, a level runs in on a reef from a short cross-cut. The reef is cut off northward by a fault. The channel at this level is bounded by walls on the east and west sides. These are 30 feet apart, and between them is mixed country rock and quartz. The whole 30 feet of material, as broken out, is crushed, and gives good returns. At the 950-feet level, north of the shaft, there is a wide reef in the stopes above the level, which shows gold freely. This is cut off by a vertical transverse fault, and northward of the fault there is a width of 30 feet to 40 feet of mixed quartz and country rock, the whole of which is sent to the mill. The pitch of the country rocks is northward. The reef pitches with the country rocks, and also conforms to their dip (east). At the 850 feet level, in a level 240 feet to east, off a cross-cut 90 feet to west, a quartz reef that is promising in appearance is being driven upon. This is the most southerly working in the mine.

For years the workings in this mine were principally on the western wall, and nothing of a payable character was obtained. Later, drives were run along the east wall, and with most favorable results. There are extremely large bodies of quartz in this mine, and some of them have been proved profitable to work to a width of 30 to 40 feet, crushing all the material as broken out. To thoroughly prospect and open up this property will require many years of work. In depth there are thousands of feet still to be penetrated. Southward of the present workings there is a great length of the lode that, from the surface downward, has had nothing done upon it. Vigorous prospecting and opening up along this great lode would probably lay bare extensive bodies of quartz that could be worked profitably, judging by the previous history of the mine.

THE TARGET MINE.

Here an adit has been driven about 900 feet along the strike of the strata; then a cross-cut has been put in east for about 300 feet; then a level north 150 feet and south 100 feet. A rise of 80 feet has been made from where the level and cross-cut join. The reef is irregular in thickness, but is now being worked on a bulge. It appears to conform with the strike and dip of the country rocks.

So far as observed at Tarrengower, the rocks appear to be dipping generally to the east, and this suggests an over thrust to the west. The shoots of auriferous quartz also appear to pitch in the same direction as the stratified rocks. Extreme metamorphism has taken place in the sedimentary beds (Ordovician), producing hornstone and schists from what were, previous to the granite intrusions, sandstones, slates, and mudstones.

Some of the hornstones are crowded, near the granite contact, with what appear to be tourmaline, hornblende, and garnet crystals. Maldonite, in small quantities, is found in most of the mines, but the two mines where it has been found most abundantly, are the old Nuggety Reef and the North British.

In these highly metamorphosed rocks, the quartz reefs have proved exceedingly productive in gold, even right up to the boundaries of the granite itself, as in the case of the famous Nuggety Reef, so well described by the late Professor Ulrich, and also in the case of Sailor Bill's Reef. So that, at localities like Bendigo, no misgivings need be felt as to whether the reefs will continue to be auriferous as they approach the granite mass which probably underlies the whole of that field.

Faults are very conspicuous at Maldon, and the recovery of rich shoots of quartz that have been displaced in this way occupies much time, and is expensive. The South German and North British mines have both had their rich shoots of ore cut off by faults.

In such cases a careful survey should be made, and, when necessary, an accurate model should be constructed, to facilitate the recovery of the lost reef. The general rule is, in ordinary faults, to follow the larger angle; but in reversed faults, such as those that agree with the strike of the beds, but not with the dip, the smaller angle has to be followed.

This gold-field has produced immense wealth in the past, and when the relative extent of what has been explored is compared with what is so far untouched, an impression is left that the mining industry has a good future at Maldon.

[*Report sent in 20th May, 1905.*]

THE CHARLOTTE PLAINS DEEP LEADS.

(NO. 12 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

For many years past efforts have been made to test the Loddon system of deep leads, and English capital has been freely spent in an endeavour to open up and drain a portion of the Clunes, Majorca, and Carisbrook Lead, to the north of Moolort Hill. This lead joins the Loddon Main Lead near the Junction Deep Lead shaft. This latter lead drains the Creswick, Daylesford, Castlemaine, and Maldon districts, an area several times as large as that drained by the Carisbrook Lead.

On the Carisbrook Lead, a shaft has been sunk at the Havillah mine, 345 feet to the main reef level, and a drive run out N.E. to within 2,200 feet of the face of the drive from the Charlotte Plains mine. At this mine a shaft has been sunk 339 feet, to the main reef level, and thence a drive runs in a westerly direction for 1,240 feet; thence S.W. 2,500 feet. Along this drive, from the shaft to the face, an electric motor tram runs. The Junction Deep Leads shaft is situate near the junction of the Carisbrook and Loddon Main Lead.

Powerful electric pumping plants are at work at the Havillah, Charlotte Plains, and Junction Deep Mines, and after years of continuous pumping there is a near prospect of getting into the wash-dirt to test it. The main reef drives are, for the most part, in glacial conglomerate, but partly also in Ordovician slates and sandstones, that have a favorable appearance as regards being auriferous. Glacial conglomerate forms a considerable area of the floor on which the auriferous gravels rest, and as the top portion decays into a tough clay, the gold is arrested, and it forms a good bottom. But the glacial conglomerate is non-auriferous, and, therefore, does not contribute gold to the gravels. The Ordovician rocks do contribute gold to the gravels, and already the drives put through the sandstones and slates have cut veins of auriferous quartz, so the Hon. Drysdale Brown, M.P., informs me.

It is noticeable that the timber in the glacial conglomerate which is impervious to water, decays more rapidly than the timber used in the Ordovician rocks through which water percolates freely. Much of the timber is thickly covered with fungoid growth, although it has only been a short time in the mine, *and the question arises whether, by spraying with, perhaps, an arsenical solution, the fungoid growth could be arrested.*

In May, 1902, when the present company took charge of these mines, the pressure of the water in the main drives was 98 lbs. per square inch. By continuous pumping, this has been reduced to 10 lbs. per square inch. An intermediate level is now being driven along the reef level at the Charlotte Plains mine, so that at an early date a drive may be run out into the wash-dirt itself.

Valuable data respecting the curves that form the water level from the pumping stations should be secured from the records being made at the above mines. These curves represent the resistance offered by the material through which the water flows in seeking the lowest level, and, of course, they will be affected differently, according to the material to be traversed.

In magnitude, the present operations eclipse all previous deep alluvial mining in the State, and the result of these operations must exercise a potent influence on the gold mining industry in the near future. If successful, a great expansion of deep alluvial gold mining will take place, and there will be room for the employment of thousands of miners.

As a great deal of driving would take place in the slate and sandstone beds, auriferous reefs would no doubt be discovered, as was the case in the Sebastopol and other alluvial mines.

When the water has been lowered sufficiently at Charlotte Plains to allow of the removal of the wash-dirt, a considerable length of drives through the drift will be necessary before the average value of it can be determined, owing to the sorting process that goes on during the deposition of gravel in a stream bed.

Where a stream takes a bend, the gold and heavier materials are deposited on the inner side of the bend at A, thus—

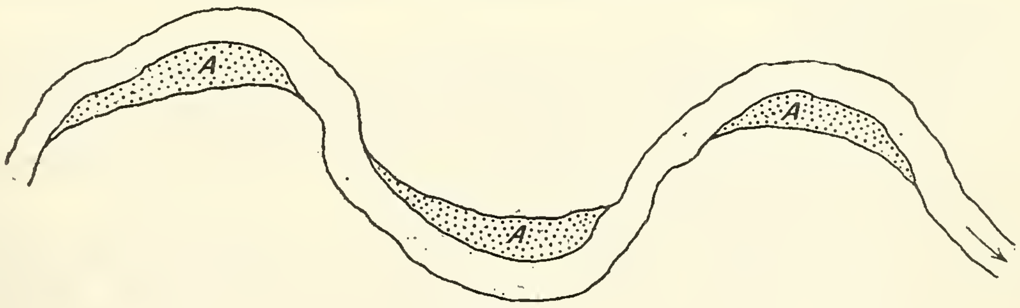


FIG. 3.

The reason is that there is considerable scouring on the outer side of the curve, as the velocity is greatest there. On the inner side, the water flows with less velocity, and in some cases forms dead water; in such places heavy material is deposited.

The above diagram shows the position (A) in which gold is deposited along the banks of a stream. In the case of these deep leads, the whole of the bed has been filled in, and the lead—as worked underground, perhaps hundreds of feet below the present surface—is somewhat as under—

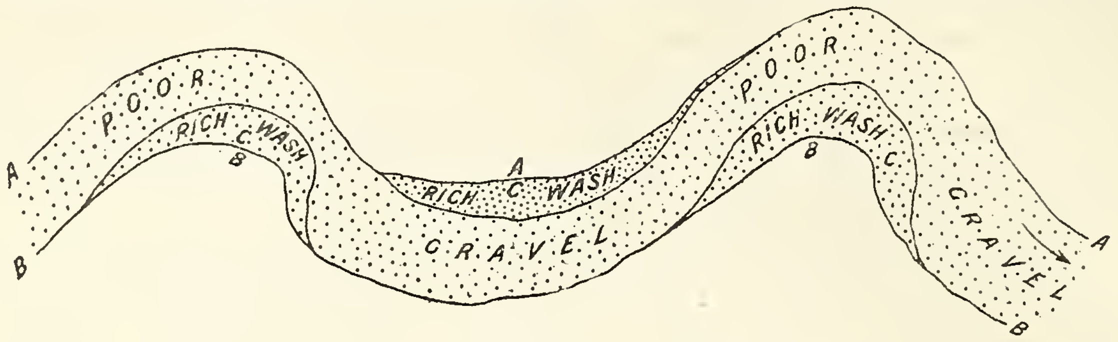


FIG. 4.

The two lines (AB) are the boundaries of the lead, and between them the whole space is occupied by wash-dirt. The richest portions of the wash-dirt will be in the position shown by dotted areas (C), on the above diagram, and very probably the actual channel of the stream will be filled in with drift, not so thoroughly sorted, and not so rich in gold. In the ordinary surface alluvial workings, the richest portions of the drift have been found on the inner side of the bends. In deep alluvial mines, the variations in the value of the wash-dirt are great within a small area, and the explanation is in some cases as above. Another cause of variation in the richness of the auriferous gravels is that where the water holes existed in the former course of the stream, the gold is not met with in the deepest part, but on the slope where the stream enters the water hole, thus:

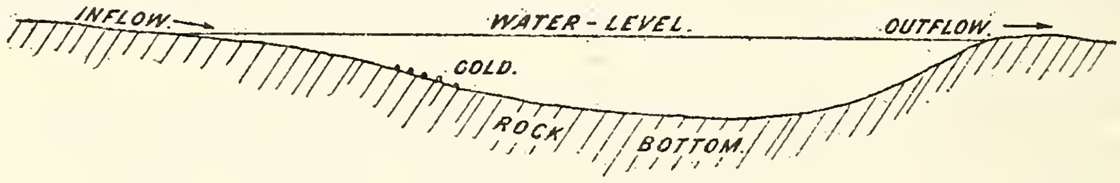


FIG. 5.

This corresponds to what takes place in an ordinary sluice-box.

Generally the deeper portions of such depressions are filled in with clean-washed gravels, that carry very little or no gold. Where a strong current has run in the old channel, the gold is often found, not in the bottom of the channel, but on the sides, as shown in the cross section below.

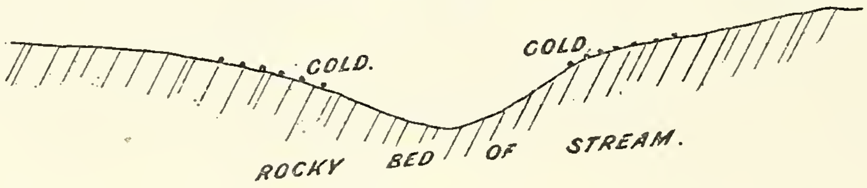


FIG. 6.

Where the gold is shotty, however, or nuggety, it remained in some cases on a hard bottom.

When the beds of streams are rocky, and have much fall, the gold has generally been swept down them and deposited in a spot where the inclination is less, or where the bottom is more clayey or soft, and therefore more favorable for retaining the gold.

In the deep leads of Ballarat, the channel of the stream was in many cases occupied by extremely rich wash-dirt. This was owing to the nature of the bottom (pipe-clay), and to the low inclination of the bed of the old stream. At Reid's Creek, near Beechworth, the former creek bed was occupied by extremely rich wash-dirt, that in places yielded at the rate of 1 lb. of gold to the square foot of bottom. The wash-dirt was about 1 foot thick, and the pebbles, &c., were commingled with fine clay. In this case, the bed of the stream was decomposed granite, and the fall was slight.

[*Report sent in 9th June, 1905.*]

SOME GOLD MINES AT EGERTON.

(NO. 13 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director Geological Survey.

THE EGERTON-MASCOTTE MINE.

Two shafts have been sunk by the Egerton-Mascotte Company, to work that alluvial lead which begins at the eastern side of the Quarry Reef, and runs under the basalt in the more eastern shaft. The general course of the leads, so far as worked, is easterly, but there is a doubt as to its further course. Boring alone can determine its direction.

The new shaft (most easterly one) is sunk to a depth of 150 feet. The section, as furnished by the manager, Mr. Hepburn, is as under:—

	Feet.
Soil	1
Clay	8
Vesicular basalt	67
Volcanic ash, &c.	1
Black clay	3
Yellow clay	3
Washdirt	2
Glacial clay	7
Glacial conglomerate	58
Total	150

The Glacial conglomerate has decomposed on the upper surface, thus forming the 7 feet of clay on which the wash-dirt rests.

In the old shaft close by, the wash-dirt commences about 13 feet north of the shaft, and continues for a width of about 25 feet. The wash-dirt in the gutter is 5 or 6 feet thick. Prospects washed from this showed gold in small flattened grains. From the new shaft, which pierces basalt, this rock continues southward and eastward, and as no boring has been done the onward course of the lead is not known. A steam plant is now being erected to work this mine on an extensive scale. The poppet-heads are up, and the boilers and puddlers, &c., are on the ground and being erected.

THE EGERTON AND BLACK HORSE MINES.

At the Black Horse mine the shaft is sunk 2,000 feet. The Egerton shaft is sunk to 1,750 feet. The country rock from the surface to the 1,400-ft. level is principally grey sandstone, with darker grey slates and black slates occasionally. The whole is decomposed to 1,400 feet from the surface. To the 1,150-feet level the rocks are almost as soft and altered as at the surface. At the 1,400-feet level, 300 feet north of the shaft, a cross-cut has been driven for 700 feet. In the cross-cut, at 640 feet from the shaft, a belt of hard sedimentary rock, highly siliceous and impregnated with pyrites was cut through. It was 60 feet wide. On the eastern side of this a lode formation, 3 to 4 feet thick, dipping to the west at a high angle, was crossed. It carries copper, iron and other sulphides. Nothing appears to have been done towards opening up this lode, although its minerals render such work advisable. In the north-eastern cross-cut from the same level three dykes occur.

At the 1,108-feet level and 290 feet south-east, then 80 feet south-west, a large quartz reef, 100 feet thick, was struck. This was followed southward for 800 feet, where it thinned out to nothing, the channel or track still continuing. On the western side of this reef a dyke runs the whole way. This dyke is from a few inches to a few feet thick. It continues southward from the termination of the reef. Only a trace of gold exists in this massive quartz reef. At the 1,750-feet level the rocks are dark bluish-grey in colour, and unaltered. A cross-cut was driven south-east from this shaft, so the manager informs me, and a well-defined reef, 6 feet thick, with only traces of gold, was cut.

At the 1,600-feet level there is a blind plat. The 1,500-feet level is driven right through to the Black Horse shaft.

The Egerton workings extend below the Rose and Sister Rose workings, but no continuation of the rich shallow shoots of gold was found.

Heathcotian Rocks.

An outcrop of grey and reddish cherty beds, through which minute quartz veins ramify in a remarkable manner, occurs on a small hill 10 chains east of the Quarry Reef. The hill is about 7 chains from north to south, and nearly as wide. Ordovician rocks appear to surround it. From its lithological aspect it may safely be referred to the Heathcote series of beds. Possibly the presence of this inlier is connected with the system of faults disclosed in the Egerton mine.

Older Cainozoic (Tertiary).

About 2 miles in a north-easterly direction from Egerton is Surface Hill, on the top of a ridge. An outcrop of auriferous gravel has been sluiced here over an area of nearly two acres. The miners have sluiced off about 2 feet of wash-dirt or gravel. This rests on and is intercalated with re-arranged granitic detritus; to what depth it continues is uncertain. A shaft sunk near the top of the surfacing for a few feet leaves the matter in doubt. In the gully at the lower end of the surfacing a shaft has been sunk into glacial conglomerate. This locality deserves further prospecting, as the ridge for some distance is Tertiary rock, and other outliers of the drift may be expected in these hills. Where the Tertiary gravel has been removed, alluvial gold should be found in the recent gullies.

[*Report sent in 9th June, 1905.*]

THE MORRISON GOLD-FIELD.

(NO. 14 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

At Meredith a very wide-spread series of auriferous gravels of Cainozoic (Tertiary) age exists. It appears to belong to the older group, judging by the highly-rounded character of the pebbles. Formerly this gravel was profitably worked by means of adits for a length of 3 miles along the course of the Moorabool River. The outlet has never been satisfactorily established, and remains yet to be discovered. Nor has the inlet been clearly made out; there is ample room for this to be under the basalt to the east of the Ballark pre-emptive right.

For some years past Mr. Atchison and party have been perseveringly exploring the plateau, or area on the western side of the Moorabool River at Morrison Township, and they have put in a tunnel westerly for nearly 2,000 feet. Cross-cuts have been driven 800 feet southward from this, and northward for 499 feet. Over the whole area opened up, an auriferous gravel that is about 1 foot thick is spread. The wash-dirt consists of well-rounded quartz pebbles, commingled with pebbles of grey sandstone, derived from the floor on which the gravel rests. Thin bands of limonite, an inch or more thick, occur in the wash-dirt, and bind the pebbles together, adding greatly to the labour of breaking and reducing the quantity won per pick. The wash-dirt rests on a slightly undulating surface of conglomerate. The extent of the undulations only amounts to a few feet in the area so far opened out, as the wash-dirt is in the adit and cross-cuts almost throughout. The floor on which the gravel rests is a conglomerate of grey sandstone pebbles and boulders, well rounded, and bound together with clay. This material is just such as the rocks in the range to the north-west of the Ballark pre-emptive right would furnish. The conglomerate appears to have filled up an old valley. Some of the features of the conglomerate suggest a glacial origin, but no direct evidence could be detected.

Above the wash-dirt are beds of clay, and coarse and fine loose drift; also sand and sandy clays covered by a capping of basalt.

Mr. Atchison informs me that the wash-dirt yields from 1 to 2 dwts. of gold per ton, but the hardness of the material and the thinness of the auriferous band of gravel render it barely payable. The work already done has proved an extensive area of wash-dirt of this quality to exist, and if it were a little more productive, or if some cheaper method of winning the gold could be devised, there would be employment here for many men.

The gold is scaly, and there is difficulty in saving the fine particles by the rough method of sluicing at present in vogue. To test whether much gold is lost in the tailings, Mr. Atchison, at my request, has sent in a sample, taken from his tailings heap. A sample of wash-dirt is also to be dealt with. The tailings would cyanide well if there should prove to be sufficient gold in them.

At the extreme end of the westerly adit the ground appears to be dipping to northward. This may be merely one of the undulations, or it may be a general dip in that direction. As it would be an important matter to discover any distinct channel, Mr. Atchison has been advised to drive in a northerly direction.

ASSAY RESULTS.

Laboratory Number.		Gold, per ton of Sample.	
		dwts.	grs.
236.	Wash-dirt (quartz gravel)	5	21
237.	Headings (over wash-dirt)	nil	
238.	Cement over wash-dirt	0	8
239.	Tailings	nil	

[*Report sent in 12th June, 1905.*]

THE DAYLESFORD MINE AND THE CORNISH LINE OF REEF, DAYLESFORD.

(NO. 8 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey of Victoria.

DAYLESFORD MINE.

For over half-a-mile northward from the shaft of the Daylesford mine alluvial workings occur. Surfacing connects the alluvial gullies with the outcrops of quartz that run along the course of the axial line, or centre-country. The sources of this gold appear to be a series of spurs which cross the bedding planes of the Ordovician strata, and which have been extensively worked in the Mauritius lease, immediately north of the Daylesford lease. These spurs have a decided pitch southward towards the Daylesford Mine, but between them and the mine is a gully, and quite possibly a fault or dislocation, for the continuance in that mine of these spurs, which are reported to have been richly auriferous, has not been proved. Besides these spurs, which must have been payable, judging by the manner in which they have been worked, there is also a strong development of quartz directly in the centre-country still further to the north, in the Mauritius lease. A considerable bulk of quartz has been won along the axial line, but at present nothing is being done on this area. It could be tested most advantageously by means of a shaft sunk near centre-country, and by cross-cuts to the east and west, so as to explore all developments of quartz from centre-country, as well as to cut any spurry formation that may occur to the east or west of the axial line. From the amount of work already done in the Mauritius area, there is much encouragement for testing this tract at lower levels. The structure of the country rock resembles that at Bendigo, and similar methods of mining are recommended.

300-foot Level.—The shaft of the Daylesford Mine is 550 feet deep. At the 300-foot level in the cross-cut to the west—17 feet in—a dyke, 1 ft. 3 in. thick, dipping to the west at 68 deg., occurs. The cross-cut extends westward for 100 feet, all in west country, and appears to be approaching a syncline. The anticline, or centre-country, is right in the shaft at this level. In the eastern cross-cut, and 100 feet in, is a rise which discloses a width of 20 feet of spurry country. West of the rise is hard quartzite. Quartz spurs carrying a little gold occur in what appears to be synclinal country. The eastern cross-cut is continued for 208 feet to the face. Levels are extended to the north and south from the cross-cut at 63 feet along it. In the northern level, 36 feet in from the cross-cut, there is a dyke that crosses the reef, which is a cross-reef, and dips westerly. The country rocks are dipping to the east. Further in, the northern level and its branches disclose a great deal of country rock, through which there are many quartz spurs (irregular veins of quartz that do not lie between the bedding planes). In places a little gold is found in these spurs; but when they occur near or in centre-country they appear to be more productive of gold. Whether these spurs represent those that have been worked further to the north in the Mauritius lease, or not, cannot be determined without more data than are available. The southern level has been driven from the eastern cross-cut for 1,315 feet on a wall dipping to the west, and crossing the country rocks, which dip to the east. Quartz occurs along this wall, forming a good-sized vein in places; but, so far, it has not been found profitable to work. This lode bears a resemblance to the lodes worked formerly to great advantage in the old Cornish Mine.

400-foot Level.—At the shaft is centre-country (anticline). The pitch of the beds is 16 deg. to the south. At 30 feet to the east of the shaft is a strong leg of quartz, 3 feet thick, between bedding planes, but it is not auriferous. It cut out on driving northward, but southward it should pitch with the country rocks.

550-foot Level.—In this level centre-country (anticline) is found at 90 feet from the shaft in the western cross-cut. The centre-country is very distinct; the country rock is of favorable appearance, and in it is a small saddle-reef. A fault over this saddle-reef dips 55 deg. E. Twelve feet further west is a well-seamed leg of quartz, 9 inches thick, carrying a little gold. This dips 53 deg. W. In this western cross-cut, at 100 feet in, is a level running southward, and a rise above this level in centre-country, with a dyke, 1 ft. 4 in. thick, dipping to the west at 76 deg. At this point a little gold occurs in the quartz. At 200 feet in is a flat slide or fault, dipping westerly at 16 deg., and this fault appears to be the cause of the displacement of centre-country above it to the east, as shown by the centre-country in the shaft in both the 400 feet and 300 feet levels. At 203 feet in is a dyke; at 227 feet is the face of the cross-cut. The whole of the country rock west of the centre country dips to the west; but at the end of the cross-cut the syncline appears to be close by.

This mine has only reached a very moderate depth from the surface so far, and a great deal of work has been expended in driving long levels, which have not yielded much result. The shaft appears to be well placed as regards centre-country, and it would be good policy to continue it downwards and to cross-cut to the east and west, especially towards the anticline and across it, so as to pick up evidences of both saddle reefs and "legs." Of course, spurry country must not be neglected, nor the cross-lodes that run nearly at right angles to the bedding. Winzes or rises should be kept in centre-country all the way, to discover all saddle-reefs, and, if properly placed, such winzes would be effective in ventilating the mine.

THE CORNISH LINE OF REEF.

About 100 feet to the west of the main axial line (centre-country) that passes through the waste-tip, west of the engine-shaft of the Cornish United mines; past the old brick chimney-stack further to the south there is another fold, a minor one, along which the centre-country is well marked. It appears to commence near the old shed at the mouth of the tunnel, and near the crushing plant it is traceable on the surface a little to the west of the old brick stack. It passes about half-a-chain to the east of the new main shaft, on which a winding plant is being erected. Further southward in the gully the fold is well marked, but it could not be traced still further to the south in the deep gully, where a prominent saddle-reef accompanies centre-country on another minor fold. This would imply that the latter fold is a very minor one, and not nearly so important as the minor fold previously described. It is of interest that, along the course of this second minor fold, as well as along the first minor fold, alluvial and surface workings have been carried on right up to the centre-country, and that along centre-country on both folds quartz-mining has been carried on. In working these mines, it is necessary to keep these facts in view, so that centre-country may be well explored.

[*Report sent in 27th June, 1905.*]

THE SPRING HILLS' AND CENTRAL LEADS MINE, JERUSALEM, NEAR ALLENDALE.

(NO. 15 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey, Victoria.

Professor Gregory's paper, published as Bulletin No. 1 of the Geological Survey of Victoria, has dealt so thoroughly with the geology of this area that but a few details remain to be considered. The general sequence was that during a long period of denudation the great Berry River—a broad and powerful stream—and its tributaries eroded the Ordovician rocks down to what is now the bed of the deep leads. In the process the softer rocks were ground down to sand and clay, and carried off by the river, while the harder material, the fragments of quartz derived from the lodes that seamed the slates, sandstones, &c., were ground together, and all the more friable portions worn away until only the hardest portions of the quartz remained as great, well-rounded boulders and pebbles—some of the boulders ranging up to 2 or 3 tons in weight, and many of them running from one to several hundredweights apiece. The most abundant, however, are what Professor Gregory aptly describes as "cannon shot," the well-rounded quartz pebbles that form the bulk of the wash-dirt. Between the pebbles is finer drift material, and throughout the wash-dirt is a little clay, just enough to make it adherent. This is a characteristic of good wash-dirt, and throughout such the particles of gold are disseminated from top to bottom. When the gravel is clean washed, and free from this small amount of clay, there is usually an absence of gold also. Actual sections of the wash-dirt are as under:—

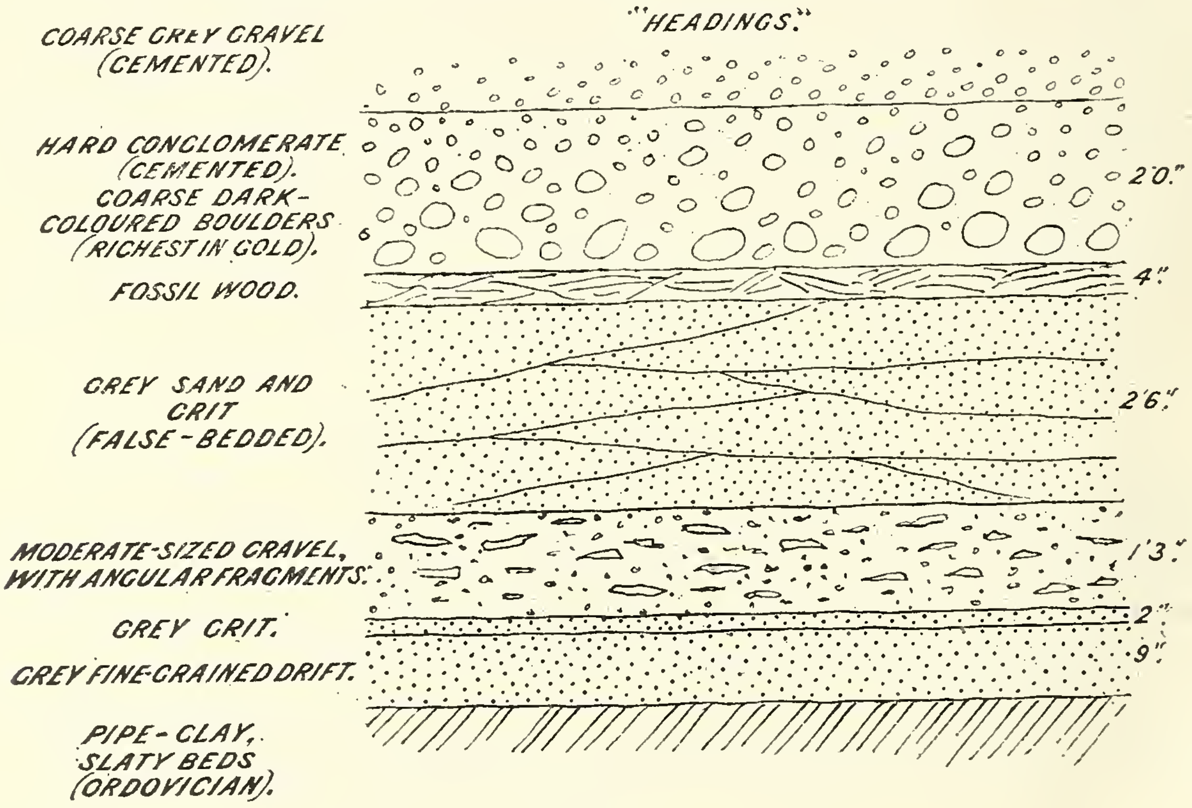

"HEADINGS."
COARSE GREY GRAVEL (CEMENTED).
HARD CONGLOMERATE (CEMENTED).
COARSE DARK-COLOURED BOULDERS (RICHEST IN GOLD).
2'0."
FOSSIL WOOD.
4."
GREY SAND AND GRIT (FALSE-BEDDED).
2'6."
MODERATE-SIZED GRAVEL, WITH ANGULAR FRAGMENTS.
1'3."
GREY GRIT.
2."
GREY FINE-GRAINED DRIFT.
9."
PIPE-CLAY, SLATY BEDS (ORDOVICIAN).

FIG. 7.

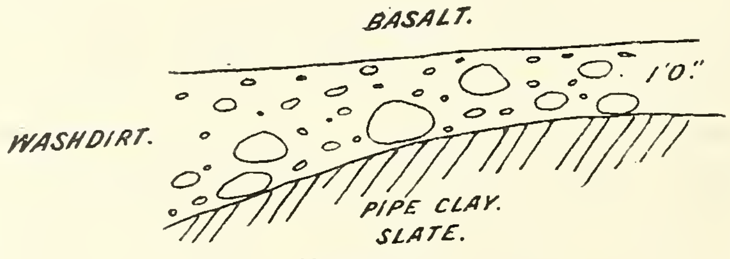


FIG. 8.

In extracting the wash-dirt, the large boulders of quartz are left below. Some of these are never moved, as they are of immense size. Mr. R. Smyth, of Allendale, formerly the mining manager of the Ristori Creek, informs me that at Mount Greenock they drove along a quartz boulder for 13 feet. Its height and width were not ascertained. In the old lead, east of Creswick, boulders of quartz up to 3 or 4 tons, well rounded and smooth, were exposed, resting on the edges of the sandstones and slate. Such large boulders could not have been borne by water far from their source of origin. The rounding of pebbles and boulders is partly due to the percussion of the pebbles, the one against the other, but probably most of the work of attrition is caused by the particles of sand borne along by the current, which acts as a ceaseless rasp, wearing down and smoothing everything passed over. The sand also suffers from the contact, and small particles become still smaller, until they are reduced to fine silt, and this is the ultimate goal of even the coarser materials, only they have periods of rest on their way.

In the Ristori No. 2 shaft, near Allendale, pebbles of quartz were found with green stains (carbonate of copper). On breaking these open dendrites of metallic copper were observed in the cleavages of the pebbles. Mr. Smyth, former mine manager of this mine, states that to the west of the shaft a copper lode, 2 inches thick, was cut in driving, and that in it native copper occurred; also that a great deal of native copper was found with the gold in the wash-dirt. This copper was picked out and treated separately for the gold it contained. In the Berry Lead the wash-dirt ranges up to 7 or 8 feet in thickness. In places it is bound together into a hard conglomerate by iron pyrites. In other places it is bound together probably by siliceous material, for the pebbles break across rather than become detached from the matrix. Some of this conglomerate is of dark grey, almost black, colour. Fossil wood occurs frequently; a sample was tested for gold, but none found in it. If these deep alluvial waters contain gold in solution, fossil wood would be a likely place for deposition to take place. In the Spring Hills Mine, the gold is of dark brownish-yellowish colour, and of high quality, selling at £4 3s. per oz. Most of it is in small, well water-worn, flattened grains; some pellets range up to 1 dwt. each. The very fine gold worn off the larger grains and particles should be in the slimes, and an average of the "slum" from this mine is to be assayed.†

Good yields of gold occur, as a rule, when the wash-dirt is coarsest and heaviest. Often the best wash-dirt lies several feet above the pipe-clay bottom. The most favorable conditions for a good yield are where the wash-dirt is from 2 to 3 feet thick, of heavy character, and resting directly upon the pipe-clay bottom.

The great abundance of gold in the Berry Lead and its branches indicates that belts of Ordovician sandstones and slates, underneath and alongside of the old stream beds, were traversed by richly auriferous quartz veins. In working the alluvial mines the reef drives frequently intersected quartz reefs. Mr. Browne, mining manager of the Spring Hills mine, states that in the Lord Harry mine, Clementston, 600 feet from the surface, and 200 feet east of the shaft, there is a reef 60 feet through, which was not tested for gold, but that the exceedingly rich Earl of Beaconsfield gutter ran alongside this reef. About 1½ miles southerly from Allendale, Ordovician rocks are exposed, showing an abundance of quartz veins, which appear to have scarcely been prospected at all for gold.

The subsidences that have taken place at the Spring Hill mine are of great interest from a geological point of view, and from a mining standpoint are disastrous, for by this means a considerable area of auriferous wash-dirt has been lost to the company. In the Main Reef drive, No. 1 east branch, the section is as under:—

---

† Assay proved the average value of the slimes to be 10 grains of gold per ton.

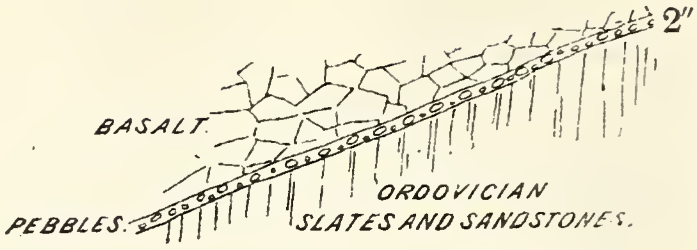


FIG. 9.

The position of the pebbles, which are evidently derived from the wash-dirt, is about 40 feet below the bottom of the gutter. They indicate the direction in which the valuable wash-dirt has disappeared, but not the extent of the subsidence. Bore holes sunk further eastward prove that the subsidence amounts to hundreds of feet. This is probably the only instance known in the State where a portion of an alluvial lead has been lost through subsidence. At Mount Greenock, a volcano broke through the alluvial lead, and interrupted it. The material in this case was hurled out with other ejectmenta, and also borne out by the stream of molten rock. The lead was recovered and worked on the other side of the volcanic neck. Still another instance of an alluvial lead being interrupted by volcanic agency is at Wombat Hill, Daylesford, where the lead was broken through by basalt. Near the basalt the wash-dirt was pushed upward. A portion of the lead was entirely removed, and its position was occupied by basalt.

In some cases the levels of the deep alluvial leads have been materially altered, with the result that the level of a down-stream portion has been raised above a point higher up stream, as in the case of the Grand Duke Company, Timor, also at Huntly, near Bendigo, where borings prove that similar disturbances have taken place. Such occurrences accentuate the necessity for elaborate and exhaustive boring on the course of a deep lead before the site for the shaft is determined on, and before the direction of the main reef drives is settled. Hitherto the practice has been to fix the site of the shaft, and run out the main reef levels on the minimum amount of boring, and the result is that the shafts of many of the deep alluvial mines are wrongly placed, and the levels are so disposed as to entail the maximum of cost in working the mine, and in handling the wash-dirt. These errors might be greatly reduced, if not eliminated, by liberal boring as a preliminary to actual mining operations.

[*Report sent in 7th July, 1905.*]

THE OCCURRENCE OF QUARTZ SPURS AT BENDIGO.

(NO. 16 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

At Bendigo, besides the regular saddle-reefs and legs which conform to the bedding of the country-rock, and the well formed and lengthy quartz reefs that fill certain lines of faults, and cut nearly vertically almost at right angles across the "country"; or that, filling other lines of faults, cut diagonally across the bedding of the "country," though conforming more or less with the strike, there are irregular quartz veins. They occur in a most erratic manner, cutting across the sandstones and slates, and are known as "spurs." Where they occur the mixture of quartz veins and country-rock is known as "spurry country." As a factor in contributing to the gold yield, they are of great importance. A very large proportion of the mining on this field is conducted on "spurs." Johnson's Reef, Eaglehawk, the Moon group of mines, the New Red, White, and Blue, Comet, and many others have obtained most of their gold from spurs. In some of these mines operations are almost or entirely confined to mining the "spurs," and centre-country is neglected. In other mines centre-country and saddle-reefs appear to engross all attention, and no effort appears to be made to determine whether, besides the saddle-reefs and their "legs," there may not be also "spurry country" well worth working. Correct mining principles would suggest that, while the one class of gold occurrences is carefully attended to the other should not be neglected. There are mines which have been worked to great depths after saddle-reefs, and in which practically nothing has been done to prove whether auriferous spurs are, or are not, existent within their boundaries. From a personal knowledge of the field, it appears highly probable that, where one class of mining has been specially followed to the exclusion of the other, great advantage might accrue from a thorough consideration of this question, and where spurs only have been worked a winze in centre-country might result in valuable discoveries. Where saddle-reefs only have hitherto been worked, the putting out of cross-cuts and prospecting along levels in search of "spurs" might also be attended to.

It is a remarkable fact that spurs are worked for the most part on the east side of the anticlines.

The general principles that govern the occurrence of saddle-reefs are very well understood, but conditions under which auriferous spurs occur are not yet worked out. There are certain lines of investigation that require to be followed up. The existence of zones in the great mass of stratified Ordovician rocks, some of which are barren as regards gold, and some of which are productive wherever quartz veins intersect, or come in contact with them, appears to be the principle which explains the presence of gold where it is found. In the case of the Comet mine, Mr. H. S. Whitelaw's survey shows that there are four zones or beds which appear favorable to the occurrence of auriferous spurs. The influence of certain beds on the presence of gold requires to be worked out on this field. Another line of inquiry, bearing on the occurrence of spurs, is in respect to the reasons why the spurs are found at considerable distances from centre-country. A possible reason might be the strains exerted on the beds while they were being folded over into a series of corrugations. Just as at centre-country, and all along the axial lines, much compression and crushing have taken place, so, between the anticlines and synclines, probably a dragging may have had the effect of fissuring the beds, and thus allowing the formation of quartz veins and gold in them. If this effect took place, where the beds of rock were favorable to the occurrence of gold, or in other words, in beds resembling the Indicators at Ballarat, then quartz veins carrying gold resulted. If the effect took place in beds of a barren character, then quartz veins, without gold, were formed. It is very probable that mechanical causes are, at any rate, partly accountable for the formation of spurs, auriferous and non-auriferous.

[*Report sent in 7th July, 1905.*]

THE BERRINGA GOLD-FIELD.

(NO. 17 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

At Berringa, the country-rock consists of greenish-grey and brownish sandstones, with less abundant beds of slate, olive-grey or grey in colour. In some of the mines, the Birthday Tunnel for instance, the slates are of the dark-grey colour so common at Bendigo in unaltered rock.

The mines at work are in a narrow belt of country that probably extends right through from the South Birthday Mine to the Staffordshire Reef. On this belt the following mines are at work, and contiguous to each other. Beginning at the south end are the South Birthday, Birthday, Williams' Fancy, Kangaroo, and the Birthday Tunnel, which is the most northern of the group now at work. The Staffordshire Reef is about 2 miles further north, but is not being worked.

THE SOUTH BIRTHDAY MINE.

In the South Birthday mine the shaft is 930 feet deep. The country-rocks dip to the west, and appear to have a fold in the cross-cut. At the shaft a fault or "slide" cuts through the beds, and intersects the quartz reef west of the shaft, between the Nos. 6 and 7 levels. West from the shaft, 222 feet, at the 930-feet level, the reef occurs, 12 feet thick, dipping to the west. Where displaced by the eastern slide the reef is thrown to the east for 60 feet along the slide.

At the 600-feet level the eastern slide or fault is 200 feet west of the shaft. The pitch of the country-rocks and the quartz reef is to the south.

THE WILLIAMS FANCY MINE.

At the No. 1 level, 250 feet from surface, in the eastern cross-cut, all the beds dip to the east. A "flat slide," or nearly horizontal fault, cuts through this level and dips easterly, passing through the shaft a few feet above this level. In the northern level, about 120 feet in, there is a transverse, nearly vertical, fault, which cuts through the reef diagonally, and displaces it about 20 feet. The reef is to the east of the shaft, and has been driven on northward for 1,000 feet. The quartz ranges from a few inches to 12 or 14 feet in thickness. Southward the reef is driven on for 400 feet. The pitch of the country-rocks in the northern end of the northern level is northerly, but along most of the level there is no pitch. The quartz is auriferous right along this level, and also in the southern level.

At the No. 2 level, in the eastern cross-cut, the country-rocks all dip to the east to the end of the cross-cut. The reef dips to the west. In the western cross-cut, which is 500 feet long, centre-country occurs, and the country rocks on the western side dip to the west to the end of the cross-cut. Near the end a slide dips northerly.

At the No. 3 level, in the eastern cross-cut, all the beds dip to the east. A level has been driven on the reef northerly for 500 feet. A succession of transverse, nearly vertical, faults cuts through the reef in a diagonal manner, moving the reef to the eastward as in No. 1 level, but the displacement is greater in this level than at No. 1.

In the No. 4 level a cross-cut has been driven 200 feet to the New Lode, and quartz, 14 feet wide, dipping to the west or parallel to the reef on which so much work has been done, has been found. This lode is said to yield $3\frac{1}{2}$ dwts. of gold per ton.

THE BIRTHDAY TUNNEL MINE.

The shaft is 496 feet deep. The reef is to the west of the shaft. A northern level has been driven for several hundred feet. In the stopes over this level extremely heavy gold has been found in the reef along the course of an olive-grey slate bed, which is apparently an indicator. I saw solid pieces of gold, up to 20 ozs. in weight, from the contact, and too much care cannot be exercised in tracing out the course of such a bed, and in following the line of its contact with the lode. As an indicator this slate bed is worth following, for, wherever quartz veins cross it, there is a likelihood of further rich deposition of gold having taken place. It is an interesting feature that, where the rich aggregation of gold occurs, it is in quartz that is highly fractured and crushed, as though the gold had been deposited subsequent to the quartz, and had crushed the quartz as it accumulated. The quartz is easily detached from the gold, which is of crystalline character. This gold appears to be due to secondary enrichment.

There are several distinct quartz reefs within this lease, and these will be accurately laid down and their relations shown by Mr. W. Baragwanath, junior.

Berringa appears to be a very important quartz mining field in its infancy. There are several known lodes, more or less parallel, and doubtless many more to be discovered, as they do not all show at the surface. The quartz bodies range from a few inches to many feet in width, and appear to carry some gold throughout, although in some mines large blocks of quartz are being left behind. There are two or three different sets of faults that dislocate the reefs, and that require to be well considered in the working of the mines. Centre-country occurs, and its importance as a datum requires to be recognised, especially where indicators exist. The course of the anticlines, as far as ascertainable, will be indicated by the survey being made. There appears to be no good reason why the distance from the Birthday Tunned to the Staffordshire Reef should not also be occupied by mines.

As a field the features appear to be great abundance of quartz of a fair average quality and cheaply worked, and with heavy stamps, stonebreakers, automatic feeders, and every appliance to economise in the mining and treatment, a yield of 3 or 4 dwts. of gold per ton should pay well.

There is abundance of room for other mines than those at work, and also for the deepening and opening out on a larger scale of the existing mines. Mr. Ditchburn, the mining manager, informs me the new lode in Williams Fancy is payable. Should it open up well in the levels to be driven north and south, it means a large increase to the crushing plant to deal with it.

I am indebted to the mining managers of the several companies for much information and courtesy.

[*Report sent in 18th July, 1905.*]

THE UNION MINE, DIAMOND CREEK, NEAR MELBOURNE.

(NO. 18 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

The reef worked in this mine strikes about N. and S. (mag.), and dips to the east at about 45 deg., cutting through Silurian strata that dip to the west at about 60 deg. The country rocks consist of thick and thin bedded sandstones, inter-stratified with slates. In colour the beds are purple, grey, and brown.

On the eastern side of Diamond Creek, at Nilumbik, this reef is being sunk upon, and southward it has been worked for three-quarters of a mile. The shaft now being worked is situate on the northern bank of Diamond Creek. Southward from this shaft, which is the end of the workings in this direction, the line of reef has been traced across the alluvial flat, and payable stone, from 2 to 3 ozs. per ton, is said to have been found; but the surface water was too heavy for the appliances used.

The Allendale mine, nearly a mile still further to the south, is supposed to be on the same line of reef. The whole course of the reef appears to be in private property.

Northward from the shaft the reef has been extensively worked, but not below the 300-feet level, except at the shaft, which is 500 feet deep.

Besides the main line of reef, there are several branch lines that have also been extensively worked, and from which excellent returns have been obtained. These branches strike in a north-easterly direction from the eastern side of the main line, and are locally termed " diagonals."

As regards pitch, the general trend of the country rocks is northward, and the pitch of the old shoots is also northward.

The Union lode is of unusual character. It consists of a felspathic dyke, resembling the so-called diorites of Wood's Point and Walhalla, with a quartz vein on the hanging-wall side, and another on the foot-wall side. The dyke* ranges from a few inches up to 20 and 30 feet in thickness. The quartz reef on the hanging wall ranges from 1 inch to 2 feet thick, while the quartz reef on the footwall ranges from 2 or 3 inches up to 2 feet, with occasional bulges still larger. These quartz veins appear to have been formed in spaces left by the shrinkage of the dyke on cooling, and, as a rule, the space left on the hanging wall was greater than on the foot-wall, consequently the hanging-wall quartz reef is generally the thicker, but the foot-wall reef carries the most gold; in fact, the hanging-wall reef has not been found profitable to break out. In some places the reef on the foot-wall side lies altogether within the dyke. At Walhalla and other places quartz veins occur traversing the dykes in all directions. This is not the case in this instance. From the nature of the dyke, the persistence downward of this lode may be calculated on; but the point which requires elucidation is the manner in which auriferous shoots occur. So far as workings have been carried on, the case appears to be that, although the dyke, with its two reefs, cuts through everything, gold in paying quantity only occurs at the intersection of the foot-wall reef and certain bands of the sandstone and slate country, and the slates are considered the more favorable.

That such shoots are well worth searching for may be gathered from what Mr. Christian, the mine manager, states regarding former workings. Close to the main shaft is an adit, and Mr. Christian, senior, worked the lode about this level to the north, and is said to have obtained £60,000 worth of gold between the surface and the adit level on one shoot of gold. The last crushing recently taken from a stope below the tunnel gave a return of 542 ozs. of gold, worth £4 per oz., from 520 tons of quartz. It is stated by Mr. Christian that about 2,500 feet of gold shoots have been worked north of the shaft on the main line, besides which a considerable length of profitable shoots has been worked on the " diagonals."

Southward from the shaft the lode has still to be worked, and if it is correct that the Allendale lode is the same as the Union, then the intervening area is well worth prospecting.

---

* Assay of dyke material shows that a trace of gold exists in the iron pyrites disseminated through it.

The Union lode has proved to be a most valuable gold producer, and its present features imply permanence in depth. It has already been worked for ¾ mile in length, and this legnth may be greatly extended by prospecting. Only a very short length of the lode has been worked below the 300-feet level. The distance from Melbourne is only 16 miles.

It is intended to sink the main shaft below the 500-feet level, and to work the mine on a more extended scale. As the underlie is about 45 deg. to the east, the shaft would have been better placed if sunk further in that direction.

Sections of the lode are as under:—

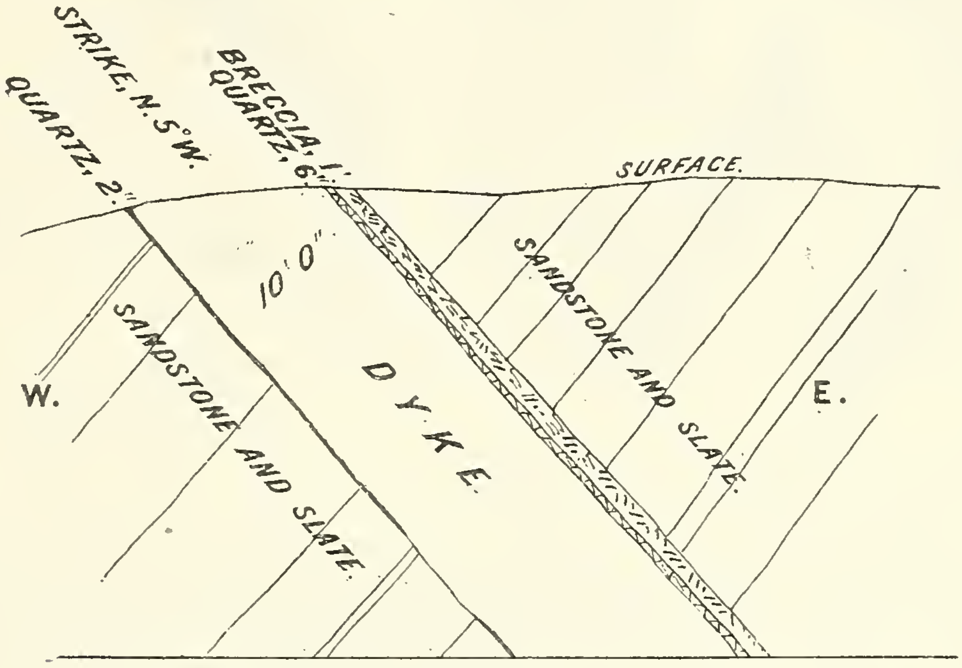


FIG. 10.

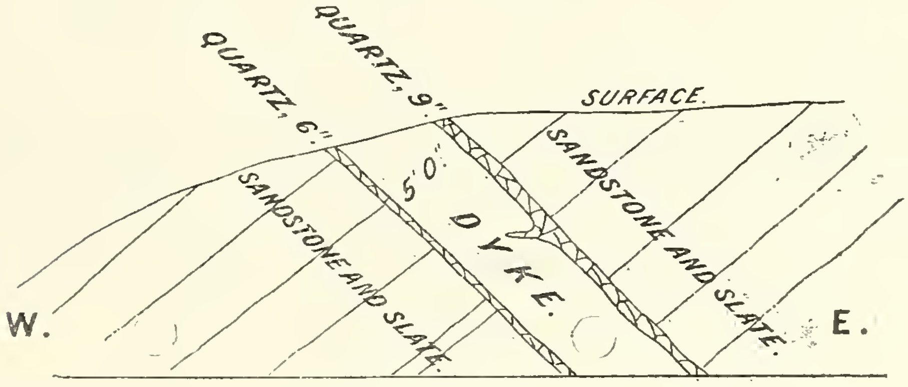


FIG. 11.

[*Report sent in 7th August, 1905.*]

THE BACK CREEK SILVER-LEAD MINE, NEAR BUCHAN, EASTERN GIPPSLAND.

(NO. 19 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

This lode is about 4 miles S. 20 deg. E. from Buchan, on the southern side of Back Creek. The country rock is limestone of Lower Devonian age. In strike and dip the lode seems to conform with the stratification of the limestone. The strike of the lode is S. 25 E., and it dips 32 degrees westerly. The outcrop on the surface appears to have been well marked for 4 or 5 chains. Two shafts have been sunk on the lode, but their depth is not known. From the surface downwards the lode was worked until a fault, filled with a dyke, cut it off. The dyke dips 85 deg. to the west along the course of Back Creek. Another and subsequent fault took place, which threw the dyke on the northern side of the creek to the east; the lode will probably be an equal distance in the same direction.

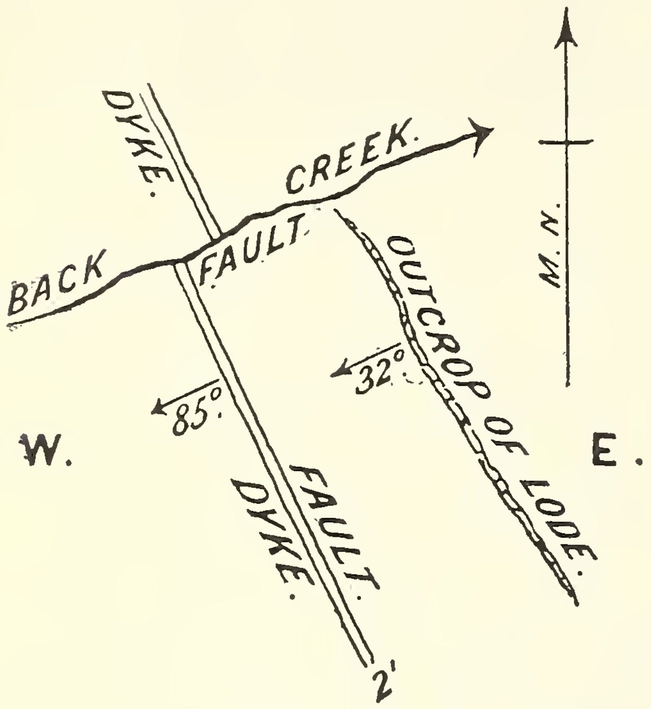


Fig. 12.

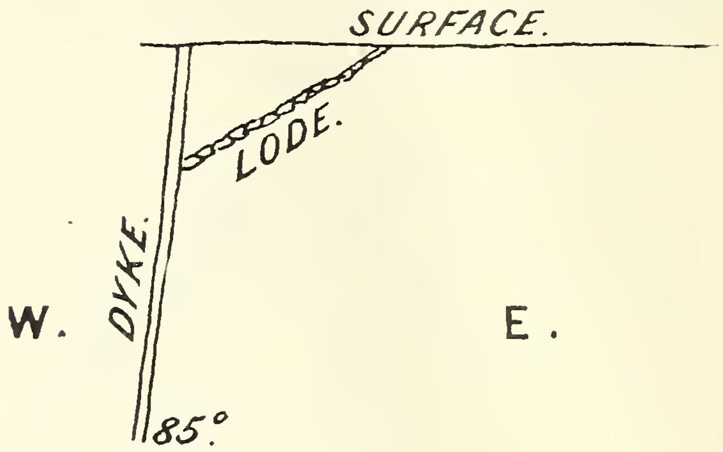


Fig. 13.

Although the ore does not cut through the strata, but runs with the bedding plane, the lode may still persist in depth—at any rate, as far as the limestone goes. In thickness the ore appears to have been from 3 inches upwards, but very irregular, occurring in bunches, according to Dr. Howitt's account of it. An old boiler and foundations indicate that considerable expense must have been incurred in installing plant at this site. Colonel Morgan, formerly of Broken Hill, had the management.

The ore left about the mine consists of galena and sulphides of iron, antimony, copper, &c., and there may remain good ore in the faulted portion of the lode, which should be found on the western side of the dyke; but, until better communication exists, it is not worth searching for.

[*Report sent in 11th August, 1905.*]

THE GLEN SHIEL SILVER LODE, GELANTIPY EAST, EASTERN GIPPSLAND.

(NO. 20 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

This lode is situate where the four grazing blocks—22, 23, 24, and 25—meet. The country rock is felspathic porphyry of the Snowy River series and Lower Devonian age. The strike of the lode is W. 5 deg. S., and dip southward, but nearly vertical. On the surface the lode is traceable by a strong quartz outcrop for 30 chains. It is particularly conspicuous on the slight rise to the west of the workings. Quartz forms the gangue, and it is in parts well laminated. In thickness the lode ranges from 3 feet to 7 feet. Altogether it appears to be of a permanent nature. Near the corner where the four blocks meet, open workings, 14 feet deep, have been made, showing 6 feet of lode. Three chains further to the west two shafts have been sunk, one 20 feet, the other 35 feet deep. The lode in the bottom of the 35 feet shaft is 5 feet 6 inches thick, so Mr. D. McRae informed me. Besides this lode, others of a similar nature are reported in this vicinity.

Ten tons of ore (quartz and micaceous hæmatite), selected from what was obtained in sinking the shafts and opening up the lode, were sent by Mr. David McRae to the Bairnsdale School of Mines for treatment. The yield was about 30 ozs. of silver and 4 dwts. 10 grs. of gold per ton of ore. This lode deserves further trial; it has been partially opened up by Mr. McRae to test its value.

Mr. D. McRae resides about 1½ miles from the workings; he showed me over the ground, and to him I am indebted for much hospitality.

There is a considerable area of Older Basalt here. The soil is good, and when the timber is killed off it affords excellent pasturage. In time it will, no doubt, be cultivated. Much of the basalt is vesicular, and in places a poor kind of opal forms amygdales in it; but the brilliant colours of the precious opal are wanting. About 30 chains to the north of Mr. D. McRae's house is a block of silicified wood, in partially decomposed basalt. It measures 1 ft. 6 in. by 1 foot by 1 foot, and must have been enveloped in a basalt flow. Another example occurs about the same distance to the south-west from the house.

About 7 miles from Buchan, on the Gelantipy-road, on the top of a high ridge of limestone, there is an outlier of Cainozoic (Tertiary) age, of well-rounded, large boulders, pebbles, &c., indicating that what is now the highest part of the country was a river bed when these were deposited. Since these were laid down hundreds of feet of the adjacent country have been removed, and great valleys scooped out.

[*Report sent in 12th August, 1905.*]

PROPOSED RESERVATION OF LIMESTONE CAVES IN THE BUCHAN DISTRICT, EASTERN GIPPSLAND.

(NO. 21 ON LOCALITY MAP.)

By A. E. Kitson, F.G.S.

In accordance with instructions I made an examination of the area adjoining the Buchan township (the Mining Reserve), applied for by B. F. Whitaker, under section 59 of the *Land Act* 1898, and also inspected the cave areas in the adjacent district to ascertain what portions (if any) should be set apart as Cave Reservations.

The localities where Cave Reserves are recommended by me, and on which separate reports are attached, are as follow:—

1. Spring Creek Caves area.
2. Buchan township area.
3. Camping Reserve, Sec. B, parish of Buchan.
4. Dickson's Caves area.
5. Basin Creek (Slocombe's) Caves area.
6. The Pyramids, Mining Reserve, Murrindal River.
7. Wilson's Caves, Recreation Reserve, adjoining allot. 8B., sec. B., parish of Buchan.

Spring Creek Caves Area.

I made a careful inspection of the area applied for, which adjoins the northern boundary of allot. 5A., of C., parish of Buchan, and the western boundary of the township of Buchan. The attached plan of the locality (Plate IX.) shows the positions of the known caves, the geological formations, the old shaft, and the adit in the bank of Cave Creek, a tributary of Spring Creek.

The geological formations in the area are Lower Devonian porphyries (felsites), tuffs, &c., and Middle Devonian limestone. The limestones overlie the porphyries and tuffs, and are found on the eastern side, with a dip to east, at from 30 degrees to 35 degrees.

Cave Creek traverses the area from the southern boundary of the Mining Reserve till joining Spring Creek, towards the northern boundary. The limestones occupy the whole of the area east of Cave Creek to the boundary of the land applied for; they also extend for a few chains in width to the west of the creek for the whole of its length in the reserve.

The largest caves are on the eastern side of Cave Creek. about 200 yards to the south-west of the north-west corner of allot. 5A., of C, as indicated on the plan.

They have been described by Mr. James Stirling, Government Geologist, in "Notes on the Buchan Caves," in the Report of the Mining Registrars for the quarter ending 31st December, 1889.

I made a personal examination of them, and found that, though the chambers explored hitherto have been greatly despoiled of their treasures by acts of pure vandalism, there are still many objects of beauty and interest in the shape of stalactites, stalagmites, mantles, columns, terraces, grottoes, caverns, &c., which make them most interesting to the scientific and curious visitor. The caves have never been systematically explored, and I have no doubt whatever that careful examination and labour will reveal numerous additional chambers adorned with beautiful stalactites, stalagmites, and stalactital drapery. In several places along the explored passages there are small openings, which probably lead to larger passages and chambers. The adoption of proper means to preserve any of such new openings from destruction is very desirable.

Besides these rather extensive caves there are two others a short distance higher up the creek, also on the eastern side. One descends from the bank of the creek into the hill for some 20 or 30 feet; but I was unable to explore it further, owing to fallen rock, which requires removal before progress is possible. The entrance to the other is near the creek level, and is at present blocked up with drift wood.

I recommend most strongly that the portion of the Mining Reserve as indicated on the plan attached, be set apart as a Caves Reserves.*

In the limestones, near their junction with the porphyries and tuffs, there is an old shaft, which was sunk some years ago for copper, while in the western bank of Cave Creek an adit was driven to work a little silver-lead ore occurring in the limestones. Neither lead nor copper, however, probably occurs here in payable quantity.

The approximate boundary between the limestones and the felsites is shown on the plan. and by reserving the area indicated thereon the probable local occurrences of such minerals will be included.

[*Report sent in 20th July, 1900.*]

BUCHAN TOWNSHIP AREA.

While examining the cave areas in the Buchan district, in connexion with an application by Mr. Gould for the purchase of certain Crown lands in the township of Buchan, I made an inspection of the unsold western portion of the township, particulars of which are submitted.

---

* The Department of Crown Lands and Survey has temporarily reserved 119 acres 1 rood 15 perches of the Mining Reserve.—See *Government Gazette* of 29th January, 1902, p. 498. E.J.D., 1.10.06.

The whole of this area is crystalline limestone of the Middle Devonian series. In the cliffs on the northern side of Spring Creek, at the point marked thus x on plan (Plate IX.), are large caves, known as the Green Caves, on account of the shrubs and ferns near the two entrances. They are of considerable extent, as far as explored, and probably extend for a much greater distance into the cliffs. On the top of the cliffs, and on the strike of the same beds that contain these caves, are two large sinks, and one smaller one, indicating a settling down of the surface into cavities dissolved in the limestone. A little further to the west, on the same cliffs, is a large sink, about 60 feet long, by 40 feet wide, and 60 feet deep. There is every probability that all these sinks are connected with the known caves, and, if so, there should be extensive passages and chambers in them, and a very fine series of caves would probably be opened up with a little time and labour.

On the southern cliffs of Spring Creek, opposite to, and almost due south from the Green Caves, is a fair sized sink, with an entrance from the creek, apparently connected with it. This entrance is at water level, and at the present time is nearly full of water, precluding any examination.

Another cave occurs in the high cliffs on the western side of the Buchan River, a little above the junction of Spring Creek, but its entrance is at present submerged.

In several other places on the southern side of the creek and on the northern slope to the creek a number of small sinks may be seen, while in the Police Reserve a basin-shaped gully has every appearance of indicating a solution cavity.

Near the junction of Spring Creek with the Buchan River, in the extreme western corner of R. Duke's allotment 18, parish of Buchan, another cave occurs. A small stream of water continually runs through it, and it has a passage nearly 600 yards in length, according to Mr. Jas. Stirling, who has examined it, as well as the Green Caves. Local report states that the stream is perennial, and shows no appreciable diminution in volume during the summer months, or increase during floods. Extended observations are necessary to speak with certainty on this matter, but, if correct, it is of considerable interest.

At the present time Cave Creek is a strongly running small stream over the felsite area near its source, but it becomes completely absorbed and ceases to run on the surface shortly after reaching the limestone area, except during floods, when it flows with considerable volume.

Spring Creek, also, ceases to flow during the summer after reaching the limestone area, although it is a large creek, in the felsite area lying to the west.

Taking into consideration the great probability of a fine series of caves being found in the cliffs on the northern side of Spring Creek, and also good ones on the southern side, I would very strongly urge that the application for the purchase of the land be refused. and the whole of the unsold portion of the township area be reserved for cave purposes*

The known limestone caves of considerable extent are so rare in Victoria that it is very desirable to retain for the Crown all areas where there is any reasonable probability of discovering caves, especially when remembering the great numbers of tourists who annually visit the Jenolan (Fish River), Yarrangobilly, Wombeyan, Wellington, and other caves in New South Wales, and the Chudleigh caves in Tasmania.

[*Report sent in 23rd July, 1900.*]

---

* The Department of Crown Lands and Survey has temporarily reserved 160 acres, the unsold portion of the Buchan Township area.—See *Government Gazette* of 19th July, 1901, p. 2772. E.J.D., 1.10.06.

Camping Reserve, Section B, Parish of Buchan.

This reserve comprises 18 acres 2 roods 29 perches, and is situated between allotments 18, 19, 22, and 24, section B, Parish of Buchan, about 6 miles to the north of the township.

It is covered with large and small "sinks" of swallow holes formed by the dissolving away of the Middle Devonian limestone. Some of them have open exits in the sides and bottoms, showing holes descending to considerable depths. A small creek takes its rise in the locality, but the water becomes swallowed up by these sinks, and only forms a channel lower down. In allotment 18c (D. O'Rourke), it subsequently runs into a cave in the side of the hill, and lower down reappears at the surface before flowing into the Buchan River.

The adjoining allotments, especially 22 and 24, possess numerous sinks, and Mr. T. Wyatt informed me that he had explored a cave in his allotment, No. 24, for a considerable distance, until compelled to desist through bad air.

Exploration will doubtless reveal numerous caves in this locality.

Allotment No. 24 is held under a tenure giving right to the freehold of the land, but allotment 22 is held under section 32, *Land Act* 1890, and therefore will admit of reservation of portion.

I therefore recommend that the whole of the Camping Reserve (18 acres 2 roods 29 perches) be made a Cave Reservation, and also such portion of the adjoining allotment 22A, as would be found by survey to be desirable.[*]

[*Report sent in 20th July, 1900.*]

Dickson's Caves.

These caves are situated on allot. 133, section B, Parish of Buchan. The land is held by R. Proudlock, under section 32, *Land Act* 1890.

It lies opposite to land owned by J. and P. B. Dickson, from whom the caves derived their name before the present lessee selected the area.

There are two entrances, and the caverns are larger and loftier than those of Wilson's Caves. Some of the chambers are really imposing, and, though but sparsely decorated with stalactital drapery, are of considerable grandeur, especially when strong magnesium light is thrown upon them.

They are by no means well explored. Numerous small narrow and winding passages can be seen branching off in various directions, and also descending rapidly. Several of those examined possessed small but pretty stalactites, stalagmites, and terraces.

The caves are about 50 yards from Mr. Proudlock's house, and the entrances are within 100 yards of the main road.

An area of 10 acres at least should be set apart as a Cave Reserve, and access given to it from the road.[†]

The entrance should be fitted with doors, and kept locked. Probably Mr. Proudlock would be willing to take charge of the key at a nominal annual consideration, or for the use of the grass on the area so reserved. The expense of fitting doors to the entrances would be very small.

[*Report sent in 20th July, 1900.*]

---

[*] The Department of Crown Lands and Survey has temporarily reserved the Camping Reserve of 18a. 3r. 29p., and a Reserve of 10a. 0r. 29p., in Allotment 22A, parish of Buchan.—See *Government Gazette* of 23rd September, 1887, p. 2760, and of 31st December, 1901, p. 5096, respectively.—E. J. D., 1.10.06.

[†] The Department of Crown Lands and Survey has temporarily reserved 2a. 2r. 0p. with access to main road.—See *Government Gazette* of 27th August, 1902, p. 3595.—E. J. D., 1.10.06.

BASIN CREEK (SLOCOMBE'S) CAVES.

I was not able to visit these caves, but have been informed by Mr. A. M. Howitt that they are situated on allotment 69, Parish of Buchan, near the source of Blue Bullock Creek, a tributary of the Snowy River.

The land is held under section 32, *Land Act* 1890, by T. B. Slocombe, who takes a most refreshing and praiseworthy interest in the preservation of the caves, and allows no one to view them unless in his company. The caves are reported by Mr. W. H. Ferguson as being more beautiful than any of the other known ones in the district, and they have not suffered spoliation.

I recommend that a suitable area be reserved as a Cave Reserve, but suggest that every consideration be shown to Mr. Slocombe with regard to the excision of such land from his lease.*

[*Report sent in 20th July, 1900.*]

THE PYRAMIDS, MINING RESERVE, MURRINDAL RIVER.

This name has been given by the local residents to thick pillars of limestone on the summit of the cliffs on the northern portion of the Mining Reserve, lying between allotment 2 (now 23 of B), Parish of Buchan, and the Murrindal River.

The cliffs are 300 or 400 feet above the river, and the rocks consist of Middle Devonian limestones, lying on Lower Devonian tuffs and quartz-porphyries. On the summit the limestones have weathered away by circumdenudation, leaving several blocks (buttes) of varying sizes. The largest are some 40 feet in height. In addition to these isolated remnants of beds, there is a large chasm—a sink—20 to 30 yards wide, with steep cliffs on each side running up to some 60 feet, the whole forming a most picturesque scene. From the summit splendid views can be obtained, looking up and down the valley of the Murrindal. At the foot of the cliff on the northern side, the River Murrindal enters a cave bodily, and disappears for several hundred yards before emerging and again occupying its channel lower down. During the winter and spring more water than can get into the cave through the opening comes down the river, and then the surplus water flows down the channel round the bend.

In the southern portion of the Mining Reserve a cave occurs in the cliff some distance above the level of the river. Adjacent to it are the old workings of the Murrindal silver-lead mine, which is not now being worked.

The cave has several interesting chambers, but is poor in stalactital adornment. The area adjoining the reserve on the west is simply perforated by sinks, but it is purchased land, and is therefore beyond the limits of this recommendation. The Mining Reserve, however, especially the portion around the Pyramids, where several kinds of trees found nowhere else in the neighbourhood are growing, is of the greatest interest and beauty, and would become a most popular pleasure resort if the district were properly opened up to tourists. This locality offers much inducement to cave exploration.

I recommend strongly that the area be reserved for caves, and strict supervision exercised to prevent spoliation of any of its natural beauties.†

[*Report sent in 20th July, 1900.*]

---

* The Department of Crown Lands and Survey has temporarily reserved 10 acres.—See *Government Gazette* of 17th May, 1901, p. 1622.—E. J. D., 1.10.06.

† The Department of Crown Lands and Survey has temporarily reserved 86 acres, the Mining Reserve. See *Government Gazette* of 7th December, 1900, p. 4507.—E. J. D., 1.10.06.

Wilson's Caves.

These caves are situated on the Recreation Reserve, adjoining, on the east, allotment 8B, section B, Parish of Buchan. They are about 4 miles to the east of Buchan township, and have been described by Mr. James Stirling, Government Geologist.

As far as yet explored, they are of considerable extent, consisting of a number of large chambers with high roofs. Though not adorned with stalactites, or draped with stalactital coverings, to the same extent as are the Spring Creek Caves, they are much larger and more imposing caverns, having several pretty grottoes. Further exploration will probably lead to the discovery of passages leading to other chambers.

The locality in which they are situated is a very fine one for recreation purposes. The river flat opposite is rather extensive, while the low cliffs in which the entrances are merge into smooth, undulating grassy slopes, covered with pretty yellow box trees.

The area marked as a Recreation Reserve comprises 73 acres, and this at least should be set apart as a Cave Reserve.* There are several entrances, but they could be partly built up and secured by doors at comparatively little cost. It is highly desirable that this should be done, as the caves are as yet by no means ruined from a scenic point of view, although many of the more accessible stalactites have been broken.

[*Report sent in 20th July, 1900.*]

Recommendations for Cave Reservations.

In addition to my recent reports on the cave areas in the Buchan district, and recommendations therein contained for their reservation, the following general remarks are made suggesting that action be taken towards the preservation of the caves:—The township of Buchan is on the Buchan River, about 52 miles north-east from Bairnsdale, the terminus of the Gippsland railway, 171 miles to the east of Melbourne. As will be seen by the reports referred to, the explored caves on Crown lands occur in the following places, viz.:—

Spring Creek caves, on Cave Creek, at Buchan.
O'Rourke's cave on the Buchan River, at Buchan.
Green caves on Spring Creek, at Buchan.
Wilson's caves, near the Buchan River, 4 miles to the east of Buchan.
Dickson's caves, 7 miles to the north of Buchan.
Basin Creek (Slocombe's) caves on Blue Bullock Creek, 12 miles N.N.E. from Buchan.
Murrindal caves, on Murrindal River, 6 miles N.N.E. from Buchan.
Camping Reserve, section B. parish of Buchan.

Besides these caves there are others, such as Duke's, King's, &c., but they are on freehold land.

Most of the caves have been described by Mr. Jas. Stirling in the report already quoted.

Spring Creek, Wilson's, Dickson's, Green, and Basin Creek caves are particularly worthy of preservation, for though all but the last have suffered from the vandalism, carelessness, and thoughtlessness of sightseers, who have smashed most of the smaller stalactites, stalagmites, and stalactital drapery within reach, there are still quite sufficient natural beauties remaining to interest the visitor. There is also the great probability of numbers of new chambers, adorned in various ways, being discovered in all of these caves, as not one of them has yet been thoroughly explored.

---

* The Department of Crown Lands and Survey has temporarily reserved 17 acres, part of the late Recreation Reserve —See *Government Gazette* of 10th February, 1904, p. 511.—E.J.D., 1.10.1906.

To preserve the beauties still remaining, and others that may be found, it is desirable to prevent uncontrolled visiting. This can only be done by fastening the entrances in some way.

The Spring Creek caves, being much more accessible to visitors generally, on account of their proximity to the township of Buchan than any of the others, have suffered most damage, but they are most admirably formed for preservation, as only one entrance, which is high but narrow, exists. On this entrance a door or gate could very easily be fitted and kept locked when not in use. In the case of Wilson's caves there are three entrances, which would require building up before being fitted with gates or doors.

Dickson's and the Green caves have each two entrances. Those of the former could easily be secured; those of the latter would require a little more work, but nothing considerable.

O'Rourke's cave entrance was blocked by the Buchan River in flood at the time of my examination, so I cannot speak of it, while the Murrindal caves, as far as explored, are ruined. They, however, were never as beautiful as the others.

Basin Creek (Slocombe's) caves, owing to the very praiseworthy interest taken in them by Mr. Slocombe, the Crown lessee of the land they are on, are the only ones that have not suffered spoliation. He allows no one to enter them except in his company. The largest cave is at present secured by a locked door, placed there by Mr. Slocombe, so I have been informed by Mr. A. M. Howitt.

The desired supervision of the caves is a question of policy; but I would strongly urge that, to commence with, doors or gates be fitted on to the entrances of those specified. Then some local resident, thoroughly familiar with the caves, might be retained at a merely nominal allowance, the keys of all the caves except Dickson's and Basin Creek to be in his charge. A special day in the week might be set apart for visits from district residents, while strangers to the district might make their own arrangements with the guide, under fixed charges for such services, cost of lighting, &c.

In the cases of Dickson's and Basin Creek caves the same arrangement might be made with Mr. R. Proudlock, the Crown lessee of the land the former are on, and with Mr. Slocombe with regard to the latter.

The expense connected with this arrangement would be trifling, and the preservation of the many beauties of limestone caves—of such restricted occurrence in Victoria—be assured. Then, as the district became better known to, and popular with, tourists, exploratory work and the lighting of the chambers could be gradually carried out.

It may be mentioned that, in New South Wales, caves of similar character are very carefully protected, lighted by electric light and placed under the charge of experienced guides. The result is that thousands of people annually visit them, and they are known all over Australia and in many other parts of the world as well.

The limestone country generally in the Buchan district has a very pleasing aspect. The rounded grass hills, clothed with healthy manna gum and yellow box trees, have a beauty all their own, different from anything in other parts of Victoria. The numerous caves in various portions of the district, the frequency and extent of areas where "sinks" abound—caused by the subsidence of the surface into caverns created by the removal of the underlying limestone—and the picturesque river views, with their bluffs and cliffs, through one of which the Murrindal River bodily flows, all furnish objects of great interest to the lover of the beautiful in nature, and to the scientist.

When the roads to Buchan are improved, the various caves thoroughly opened up, and the claims of the district as a pleasure resort brought prominently before the public, I have no hesitation in venturing the opinion that large numbers of tourists will be attracted during the summer and autumn months, even though the caves as yet known are not as extensive or as beautiful as the best ones in New South Wales, the Jenolan and the Yarrangobilly.

I therefore strongly urge that action be taken to preserve such of the beauties of the caves as have not yet been despoiled, and prevent vandalism in any that may be discovered in future.

[*Report sent in 30th August, 1900.*]

THE BUCHĀN LIMESTONE, EASTERN GIPPSLAND.

(NO. 21 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

By far the most extensive outcrop of limestone in the State is at Buchan. In extreme length it is about 15 miles, and in the widest part it is about 5 miles across. The longer axis is north and south. The age of this limestone is Middle Devonian, as determined from the abundant fossil remains contained in it. In colour the limestone is bluish-grey. Bedding is very clearly marked. Some beds are very thick, while others are thin. Dr. Howitt estimated the thickness as between 200 and 300 feet, but from the cursory observation made by the writer it is surmised that the limestone and calcareous beds at Buchan represent many hundreds of feet in thickness. Careful cross-sections are needed to decide, even approximately, what is the thickness.

The great mass of the limestone appears to be very pure and free from silica, &c., though many of the calcareous beds probably contain but a small proportion of carbonate of lime.

In physical aspect the country occupied by limestone is in marked contrast to that occupied by other rocks. Though deeply cut into by the creeks and watercourses the contour is beautifully rounded, imparting to the landscape an agreeable appearance.

From the limestone a soil is derived that is of strong clayey nature, and most fertile, and that yields heavy crops of grain, &c. For raisin growing this soil is peculiarly adapted, and also for olive growing.

For grazing purposes the limestone country is valuable, the one defect being that it soon becomes dry, and the grass shrivels up in hot weather, unless there are frequent showers.

Geologically much has to be worked out. The approximate thickness, the relative zones of the fossils that are so abundantly present, what the peculiar conditions were that caused such a great thickness of calcareous material to accumulate over this particular area, while there is such a dearth of calcareous material in the surrounding areas and other points remain for solution.

Lodes of metallic minerals traverse the limestone at Back Creek, Murrindal River, and other places. Subsidences and depressions known as "swallow holes" are numerous at the surface, indicating that the rock below is cavernous and honeycombed with spaces from which water has dissolved the limestone. Several caves are already known and have been partially explored, but, unfortunately, most of those hitherto discovered have been injured and defaced. On Spring Creek at Buchan a reserve has been made around a cave, and some of the timber remains, adding greatly to the picturesque appearance of the spot. Some of the trees are being destroyed, however, and steps should be taken to prevent any interference with the forest growth that remains. Unfortunately the portion of the cave that has been explored has also been marred by the destruction of the stalagmitic and stalactitic growths. It is quite possible that, if the narrow passages leading from the explored parts were followed other caves might be discovered. Just outside the reserve a stream of limpid water flows out of the limestone, and along its course caves are likely to exist. Around Wilson's and some other caves reserves have been made, but with one exception no steps have been taken to preserve the wonderful and exceedingly beautiful results of Nature's art that embellish these limestone caverns.

It appears probable that what might be made an extremely valuable asset to the State is lying dormant in the Buchan caves. I have no doubt that if systematic search were made by following up the passages from the caves already known, and by exploring this great area for fresh caves, very valuable discoveries would be made, and there appears to be no reason why there should not be caves at Buchan quite as extensive and as beautiful as the famous Jenolan caves of New South Wales.

As an attraction to tourists nothing could excel such caves if they are preserved in all their natural perfection.

The Buchan limestone should be diligently explored for fresh caves, and if a reward each year for the best discovery of this kind were made the money would be well spent. But even more important than discovering such caves is the necessity for scrupulously preserving them from the outset from vandalism. When discovered—and it may mean tedious blasting or breaking away of narrow passages to explore for them—entrance gates should be provided, and the caves should be kept under lock and key until they could be lighted by electricity. They should have paths cut through them, and be thrown open for inspection without any risk of damage or deterioration.

Very large sums of money have been profitably spent in this direction in the older State, and through a wise policy these natural features have been permanently preserved, while at the same time thousands of tourists enjoy their marvellous appearance. Good roads lead to them; steps and paths have been cut and made throughout the caves, so that they may be traversed with the least possible fatigue. An excellent hotel with extensive accommodation is provided. Electric lighting enables each remarkable diversity in the draping of the caverns to be seen to the best advantage. Guides at moderate fees conduct the visitors through the labyrinths. The result is a large influx of visitors who contribute towards the prosperity of the community.

A capital round trip would be by sea—for those who prefer it—to the Gippsland Lakes, and on to Bairnsdale; thence to Buchan to view the caves, returning *viâ* Walhalla, when the Baw Baw Mountains, 5,000 feet high, could be ascended, and back to Melbourne.

At Buchan illimitable material for lime and cement-making exists, but until communication is improved these resources cannot be utilized.

The desirability of preserving and exploring the caves of Buchan has been forcibly urged by Dr. Howitt, Mr. J. Stirling, Mr. Herman, and by Mr. Kitson. Owing to the strenuous representations of Mr. Kitson, reservations have been made of areas enclosing some of the principal known caves. He has described many of them, and has persistently striven for their reservation, protection, and for their further exploration. In urging the development of the Buchan caves, and that they should be carefully secured against further spoliation, I am only reiterating the views of previous workers, who have all been impressed with their beauty and their great possibilities as an attraction to tourists from all parts.

[*Report sent in 15th August, 1905.*]

THE MOUNT TARA GOLD-FIELD, EASTERN GIPPSLAND.

(NO. 22 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey, Victoria.

MONARCH MINE.

About 5 miles, a little east of south, from Buchan is the Tara Range. The Monarch Gold Mine is on a spur trending in a northerly direction from this range. The country rock consists of felspathic material in a decomposed condition, apparently referable to the ash-beds of Lower Devonian age. The quartz reef runs about north and south, and in places splits up into small veins. In width the auriferous quartz ranges from a few inches to 6 feet, bulging out much wider in places. Workings extend along the course of the reef for a length of about 4 chains. At the southern end a shaft has been sunk 30 feet, and a shallow shaft at the northern end. Very rich stone was obtained from these workings by Messrs Johnson and Hughes.

The quantity of quartz crushed from the Monarch reef is 12 tons 14 cwts., and the yield 112 ozs. of gold.

From the excellent returns already obtained, it is reasonable to expect that other rich yields will be secured as the reef is opened up. Beyond the proof that this particular vein is, at any rate in parts, rich in gold, is the significant fact that the country rock containing the reef belongs to beds of Lower Devonian age, and, as this class of country covers a very wide area in Eastern Gippsland, it adds greatly to the extent of the gold-bearing rocks in the State.

TAEDATO CREEK GOLD WORKINGS.

From the Tara Range the above creek flows in a northerly direction, and about ¼ mile to the east of the Monarch Mine. Following this creek up for ½ mile, Mr. S. S. Keeley's house is reached, on the eastern side of the creek. About ¾ mile still further up the creek, and in a south-westerly direction, a small gully joins the creek from the north-west. In this is an outcrop of Heathcotian rocks, cherty in character, and, as usual, much jointed. The strike of the beds is east and west, and the dip to south. In crushed-looking material in these beds a little gold occurs. It is very fine, and of pale colour, evidently alloyed with much silver. This gold differs greatly in appearance and value from what is obtained from the overlying Ordovician rocks, a little higher up the spur. Right opposite this, on the other side of the creek, and 2 chains distant, is an outcrop of black cherty beds, also of Heathcotian age. A shaft has been sunk on a 6-in. quartz vein that showed green and blue carbonates of copper stains to a depth of 70 feet. Mr. Keeley informed me that a little native copper was found in sinking the shaft, and that lower down in the creek native copper is met with among the alluvial gold particles.

THE QUEEN REEF.

A little further up on the same side of the creek the Ordovician rocks appear, and in them is the Queen Reef. The strike of this reef is N. 12 deg. E., and the dip 70 deg. easterly. It has an average thickness of about 2 feet, and has been traced on the surface for about 2 chains. Most work has been done at the southern shaft, which is 20 feet deep. Here, about 30 tons of quartz, estimated to yield 2½ ozs. of gold per ton, is stacked. The northern shaft is 25 feet deep. The stone is said to vary from 4 dwts. to 4 ozs per ton; 4½ tons of quartz crushed from the Queen Reef yielded 17 ozs. 6 dwts. 19 grs. of gold.

The Micawber Mine.

Returning to where a little gold is being got in the Heathcotian rocks, and climbing for 300 yards up the spur in a westerly direction, the Micawber lease of Mr. Keeley is reached. The country rocks are Ordovician slate and sandstones, with quartz fragments strewn over the surface. The strike of the country rock is N. 17 deg. E., and the dip 50 deg. westerly. A quartz vein, 6 inches thick, has been opened here in a cutting. Its strike is about north and south, and dip nearly vertical.

This little reef is called the Cashbox, as the owner has erected a dolly, and when the necessity arises he obtains some gold by crushing the richer portions of the stone. This reef is reported to yield 3 oz. of gold per ton, worth £3 17s. 6d. per oz. For about 2 feet into the hanging wall a little gold is obtained. About 100 yards further to the west is the Micawber Reef. Its strike is about N. 5 deg. W., and dip westerly, but nearly vertical. A shaft, 25 feet deep, is sunk here. The reef is 2 to 3 feet thick, and is stoped for a length of 25 feet. In parts there is a casing that is said to be payable for 1 foot in thickness. The country rock is Ordovician soft grey slate of very favorable appearance, and quartz fragments are abundant on the surface. A total of 25 tons crushed and dollied gave a return of 60 ozs. of gold. The strike of the country rocks—sandstone and slate—at the mouth of the adit near the shaft is N.E., and dip 50 deg. S.W.

The Surprise Mine.

The Surprise mine is 200 feet further to the south, on a continuation of the Micawber reef. The shaft is 12 feet deep. This ground has not yet been opened up. There are facilities for working this reef by means of an adit, and if a battery were placed where the Heathcotian rocks cross Taedato Creek, it would serve these reefs, as well as the Queen Reef. The Taedato Creek is said to continue for over a mile into the hills from here, so that water should be secured, by constructing a dam, for several months in the year.

The Tara Range is remarkable in that, within a mile of the Micawber lease, there are three distinct series of rocks carrying auriferous veinstones. The Monarch itself is in Lower Devonian rocks. The Cashbox, Micawber, and Queen reefs are in Ordovician slates and sandstones, and in the Pre-Ordovician (Heathcotian), close by, veins carrying gold also occur. From this it will be seen how exceptionally interesting, and, it may be added, intricate, is the geology of this tract of country. The Tara Range gives promise of developing largely as a gold-field, if the country is but prospected. Other reefs around and at moderate distances have been discovered, and small crushings of an encouraging nature have been taken out. A systematic geological survey of this tract of country should be made as soon as practicable.

[*Report sent in 15th August, 1905.*]

THE DOMINION COPPER MINE, NEAR BUCHAN, EASTERN GIPPSLAND.

(NO. 22 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey, Victoria.

At this mine, which is about 7 miles, a little east of south, from Dr. Mackieson's (allotment A1, section C, Parsh of Buchan) there is a strong outcrop of quartz, striking south-east and dipping south-west, but nearly vertical. The lode has copper pyrites sparsely disseminated and also in thin seams through it. Galena and iron pyrites also occur. A shaft has been sunk 45 feet. At the surface stains of green and blue carbonate of copper attracted attention, while lower down only sulphides occur. The shaft is in a gully, and in consequence the surface water is troublesome Insufficient work has been done to prove whether valuable ore exists or not. So far as worked, the ore is very poor. Ash beds of Lower Devonian age constitute the country rock, and at a short distance porphyry outcrops. South-east from the shaft the lode thickens out to 15 feet, and is very prominent on the hillside. At the shaft the lode is about 8 feet thick. The remains of an old vertical boiler and engine are at the shaft; the protecting shed was burnt by a bush fire.

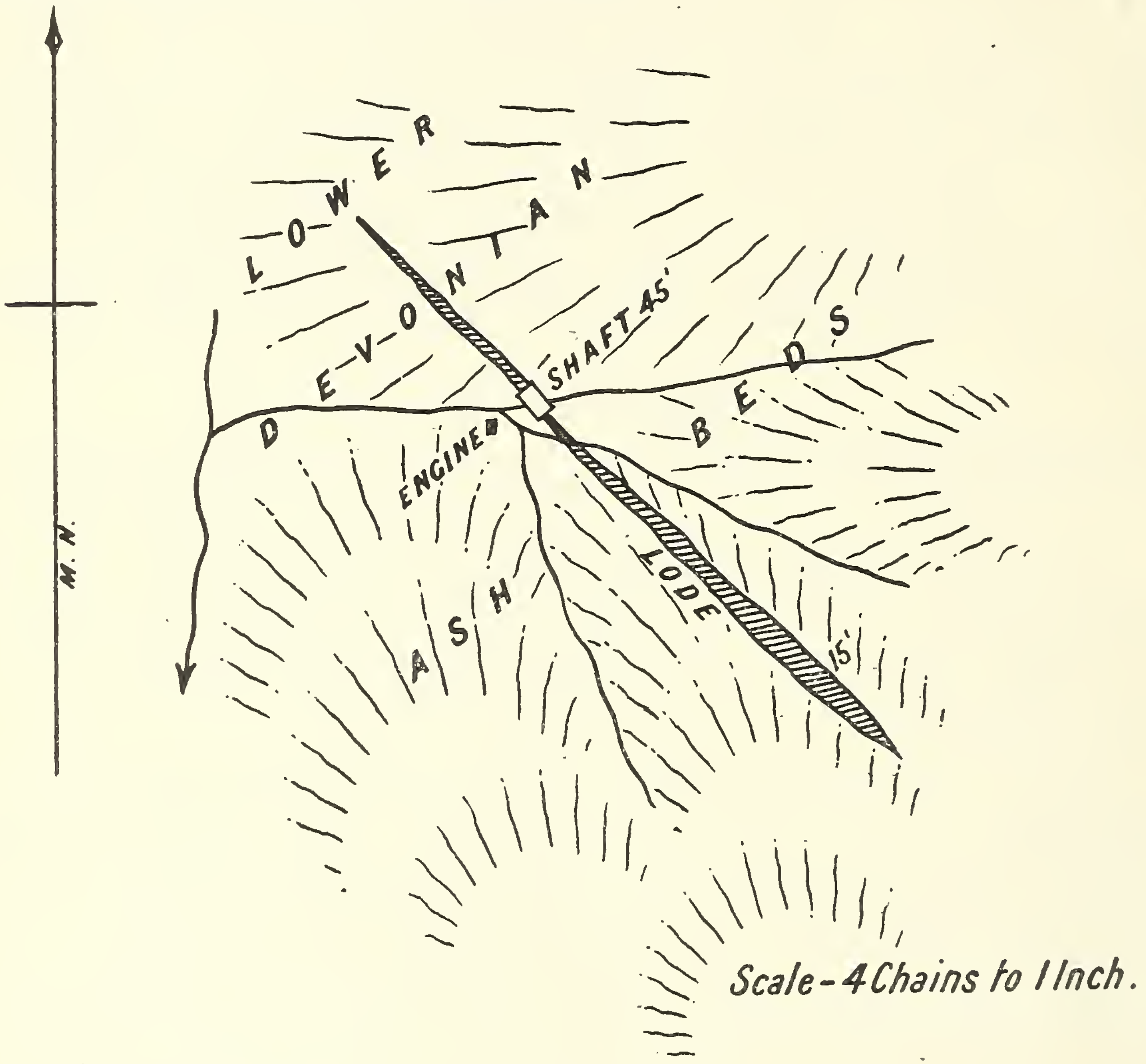


FIG. 14.

[*Report sent in 17th August, 1905.*]

THE IRON MASK FERRO-MANGANESE MINE, NEAR BUCHAN, EASTERN GIPPSLAND.

(NO. 22 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

About 6 miles southerly from Buchan, and about 3 miles S.S.E. from Dr. Mackieson's, allot. A1, section C, Parish of Buchan, is the Iron Mask lease. Ferro-manganese ore is met with in a shaft, 45 feet deep, on the western extremity of the outcrop. The surface shows large embedded masses of the ore, and north-east from this limonite in large masses is traceable at the surface. The limonite appears to be associated with Tertiary drift. Shafts, one of 20 feet in depth and another of 15 feet, have been sunk on the limonite, and some trenches made, but insufficient work has been done to prove the full extent of the ore. About 3 acres of iron ore may be considered to exist there, varying in thickness. The appearances indicate a considerable bulk of ore that would prove of value if it could be utilized with other deposits, but it is not large enough to work by itself. The limonite apparently is derived from other rocks, and, as beds of what appears to be Heathcotian crop out alongside of the deposit and to the south, it might be worth while to open out and explore these beds, so as to discover if they are very ferruginous, as they are at some other localities. The outcrop extends for 15 chains in length in a north-easterly and south-westerly direction.

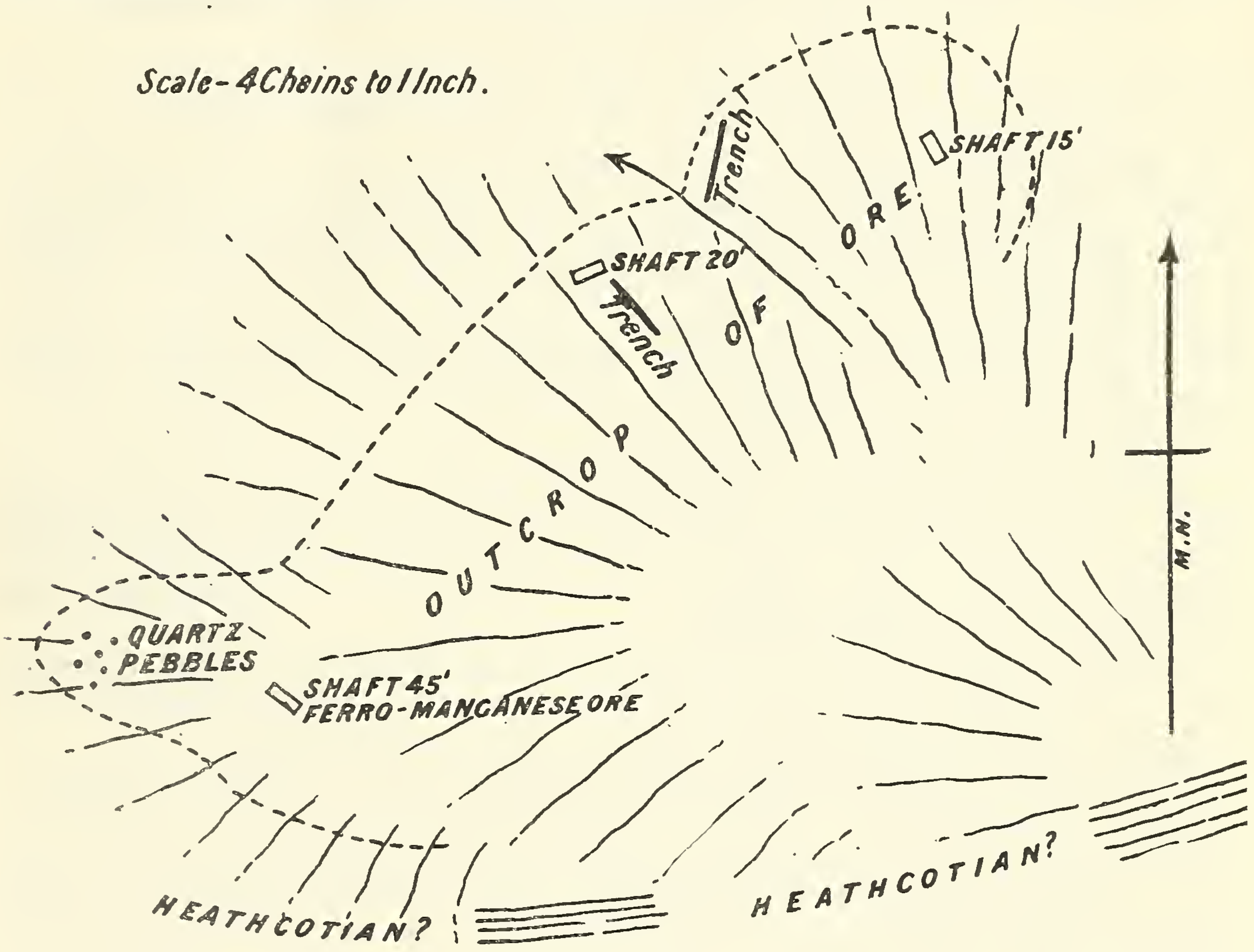


FIG. 15.

From this spot the country is smooth and easy for road-making to the main road between Buchan and Bruthen.

Still further in a southerly direction from Buchan, about 5 miles in a bearing of 12 degrees east of south from Dr. Mackieson's house, is a high ridge, running northerly from a portion of the Mount Tara range. Here a belt of ferruginous, highly siliceous beds, approaching jasper in character, occurs. Probably these beds belong to the Heathcotian series; they are of considerable extent.

These beds are rich in iron ore, but of a very siliceous nature, and non-magnetic. They are of dark red and purple colours, extremely heavy, and much jointed, and they break readily into angular fragments. Hæmatite is probably present, as the streak is bright red. Beds of this nature cross the ridge, and they are met with for quite 10 chains along the course of the ridge.

Further along the ridge, in a southerly direction, these beds give place to ash beds of Devonian age.

About 7 miles south-east from Dr. Mackieson's house is the Blue lode. It crops out near where the mining track from Nowa Nowa to the Mount

Tara range terminates. The strike of this quartz lode is about east and west, and its thickness is about 5 feet. The country rocks are ash beds of Devonian age. This lode is said to carry a little gold; it has not been much prospected. Close by is the boundary between the ash beds of Devonian age and Ordovician sandstone and slates, with much quartz strewn over the surface. A little prospecting has been done in these beds, and gold is reported to have been found. These rocks stretch in a belt for many miles, and are well worth a trial for gold.

[*Report sent in 19th August, 1905.*]

THE GOOD HOPE SILVER MINE, NEAR BUCHAN.

(NO. 22 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

About 2 miles south from Dr. Mackieson's house is the old shaft of the Good Hope Silver Mining Company, but I could obtain no particulars as to the results obtained. The rocks here are Devonian sandstones, studded with brachiopods. About half-a-mile further to the south the lode crops out on the southern bank of the creek, as a ferruginous gossan. On the western side of the shaft at the Good Hope the lode consists of ferruginous quartz at the surface. These workings were in search of silver, but I cannot obtain any account of the results achieved.

Near Sandy's, allot. 47, Parish of Nowa Nowa, and just south of the fence, is a lode of barytes, 3 feet thick. It is in ash beds, and does not appear to continue far. Limestone occurs close to the road on the eastern side of Sandy's, and limonite a little further to the north-east, but apparently not in large quantities.

At the schoolhouse, South Buchan, is an outcrop of Tertiary drift, in which are large boulders of red jasper, &c. These jasper boulders are probably derived from Heathcotian beds in the neighbourhood.

From the variety of rocks and minerals met with, this tract of country promises to be productive later on of useful materials, such as limestone, ironstone, barytes, &c., and its geological features deserve to be traced out. Especially from the Heathcotian rocks valuable minerals may be expected, and probably good mines will be worked for ores of many kinds in these ancient beds.

For much kindness and hospitality, and assistance in visiting the surrounding country, I am indebted to Dr. Mackieson, and to Mr. W. Mackieson, of South Buchan.

[*Report sent in 19th August, 1905.*]

THE CALEDONIA GOLD MINE, WARRANDYTE, NEAR MELBOURNE.

(NO. 23 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

Warrandyte is 18 miles north-east from Melbourne, and the mines one mile by road, or half-a-mile direct, north-east from the township. An engine shaft, 12 feet by 4 feet, has been sunk to a depth of 110 feet to the level, and a well is being sunk another 20 feet. Baling is done by means of a steam winch and vertical boiler. In sinking this shaft 30 feet of alluvial ground was first encountered; then about 30 feet of altered

Silurian rock, the balance being in unaltered sandstones and mudstones of light to dark grey colour. Iron pyrites is abundant in the beds.

At 300 feet north of the engine shaft is Upton's shaft, 150 feet deep, from which payable stone has been obtained. At 190 feet south of the engine shaft is the whip shaft, 110 feet deep, from which the quartz is being hauled. The prospecting shaft, 80 feet deep, is 50 feet south of the engine shaft; and on the bank of the Yarra River, still further to the south, is Grant's shaft, 90 feet deep, not now used. From this shaft quartz yielding as much as 7 ounces per ton is said to have been obtained. All these workings are on a flat on the eastern side of the Yarra.

The strike of the Silurian rocks is about north and south, and the dip at the bottom of the whim shaft is 40 degrees to east. The general strike of the reef channel is about north 32 degrees west. The pitch of the country-rocks is northward.

Auriferous quartz is being stoped at the 110-feet level and about 250 feet south from the whim shaft. This level is extended to 310 feet south from the whim shaft. There is a distinct lode formation, with up to 4 feet of broken country-rock, and a quartz veinstone between the walls. The lode channel has been fractured and displaced by a series of faults, striking a few degrees west of north; the channel in each case going north, is thrown to the west. Although the channel is thus displaced, the quartz veins are continuous across the faults, as though they had been formed later. The dip of the lode is 85 degrees to west. Besides the principal quartz vein, ranging from 3 inches up to 2 feet in thickness in the channel, there are also auriferous quartz veins, an inch or up to 3 inches thick, in the country-rocks. In fact, the country-rocks are not explored, and more cross-cuts should be put in to search for other quartz veins, especially on the western side, where centre-country must lie. Recently 205 tons of quartz have been crushed for a return of 387 ozs. 5 dwts. of gold. If properly opened up, this promises to be a productive mine. At 90 feet to the east is the Black Swan reef, from which some rich patches of quartz are reported to have been taken. This line of reef could be conveniently prospected or worked from the Caledonia workings.

Southward from the Caledonia mine, what is considered the same reef was worked as the Yarra Tunnel mine, and from it excellent returns are reported. Other reefs that have been worked in this locality are the Pig Tail (now called Hornabrook's Reward) and the Victory, right in the township of Warrandyte. The "Dyke," a few chains to the east from the Caledonia, has been extensively worked also.

[*Report sent in 28th August, 1905.*]

THE CUMBERLAND AND PHŒNIX MINE, CAMPBELL'S CREEK, CASTLEMAINE.

(NO. 24 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

The shaft now being worked is on the Phœnix line of reef. The depth of the shaft is 236 feet. The No. 1 level, 136 feet from the surface, has been driven 100 feet to the south. The pitch of the country-rocks at 30 feet south from the shaft is 33 degrees south. From this level auriferous quartz was worked across for 40 feet in width, and right up to the surface. The quartz tapered as followed upwards. This averaged about 4½ dwts. of gold per ton. A considerable proportion of country-rock is commingled with the quartz. Over the No. 1 level is an intermediate level, showing section as in Fig. 19. The wall of the reef on the western side of the shaft dips west at 55 degrees, and strikes about north and south. Very large bodies of quartz, varying from 6 to 8 feet in width, occurred at this level on a fault that dips to west at a low angle.

The No. 2 level is 186 feet from the surface. The main wall is 15 feet to the west from the shaft, with a quartz reef, 5 feet thick, on the eastern side of the wall. West of the wall all the country-rocks dip to west. All the country-rocks (slate) east from the reef dip east. The eastern cross-cut is extended 36 feet from the shaft to a wall, or "back,'' dipping east. Northward the level is extended 300 feet. Veins of quartz are abundant in the beds. At 200 feet along this level a cross-cut extends eastward for 36 feet, and from the end of this it is proposed to drill a hole eastward for 460 feet, so as to cut the Cumberland line of reef and any intervening quartz bodies.

The Cumberland line is an anticline, and therefore to bore laterally would be to run the greatest amount of risk of cutting any saddle reefs that may exist, while the chance of cutting more or less vertical and irregular quartz veins between the two lines would be remote. Horizontal boring at this site could not be recommended.

On the Phœnix line, where the present mine is being worked, the country-rocks are of a favorable character for gold, and large developments of quartz occur there; 3,132 tons have been crushed for 680 ounces of gold, worth £2,720. The bodies of quartz so far explored are of an irregular nature, and are not continuous reefs; they occur along the course of a strike fault, dipping west. They pitch to the north and south from the shaft. Similar bodies may be found at lower levels, but only sinking and exploring would decide this. As to boring vertically for such bodies, it would not be a reliable method.

The Cumberland line, also within this company's lease, was worked to a depth of 150 feet, and is reported to have given good returns of gold. A considerable amount of work has been done on the hill where the old engine shaft was sunk. This shaft appears to lie in centre-country, and as evidently a great deal of gold has been got about here, this would be a more favorable site than even the present workings. There is a belt of auriferous country at this site. The alluvial gullies have been very productive, and formerly rich yields were obtained from quartz reefs. The Cumberland and Phœnix Company is the only one at work in this neighbourhood, and it is a locality well deserving as a field for mining enterprise. Of the two lines, the Phœnix and the Cumberland, the latter is decidedly the better line to prospect, and boring from the bottom of the old shaft should be proceeded with.

The peculiar manner in which the country-rocks dip west from a few feet west of the shaft, and east to the east of that spot, although centre-country does not occur, is explained in the accompanying diagram (Fig. 16). In the corrugated Ordovician and Silurian beds of this State

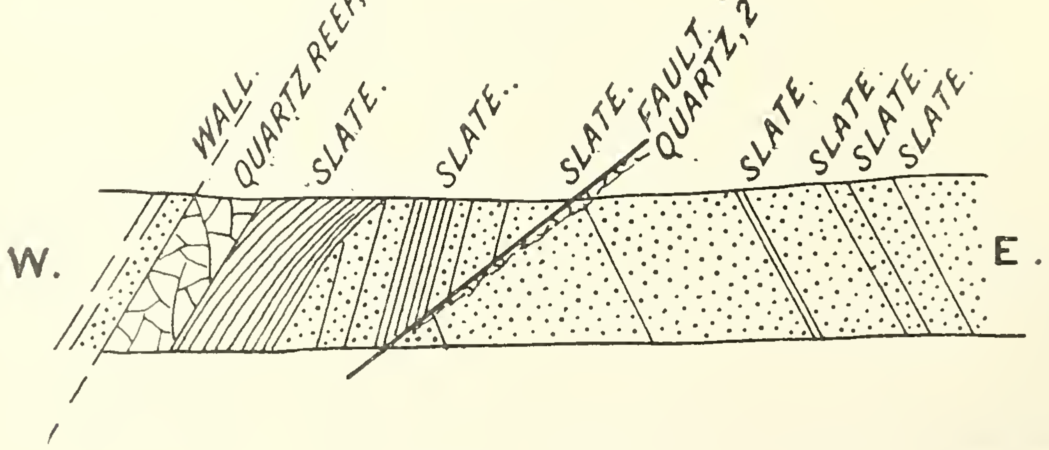
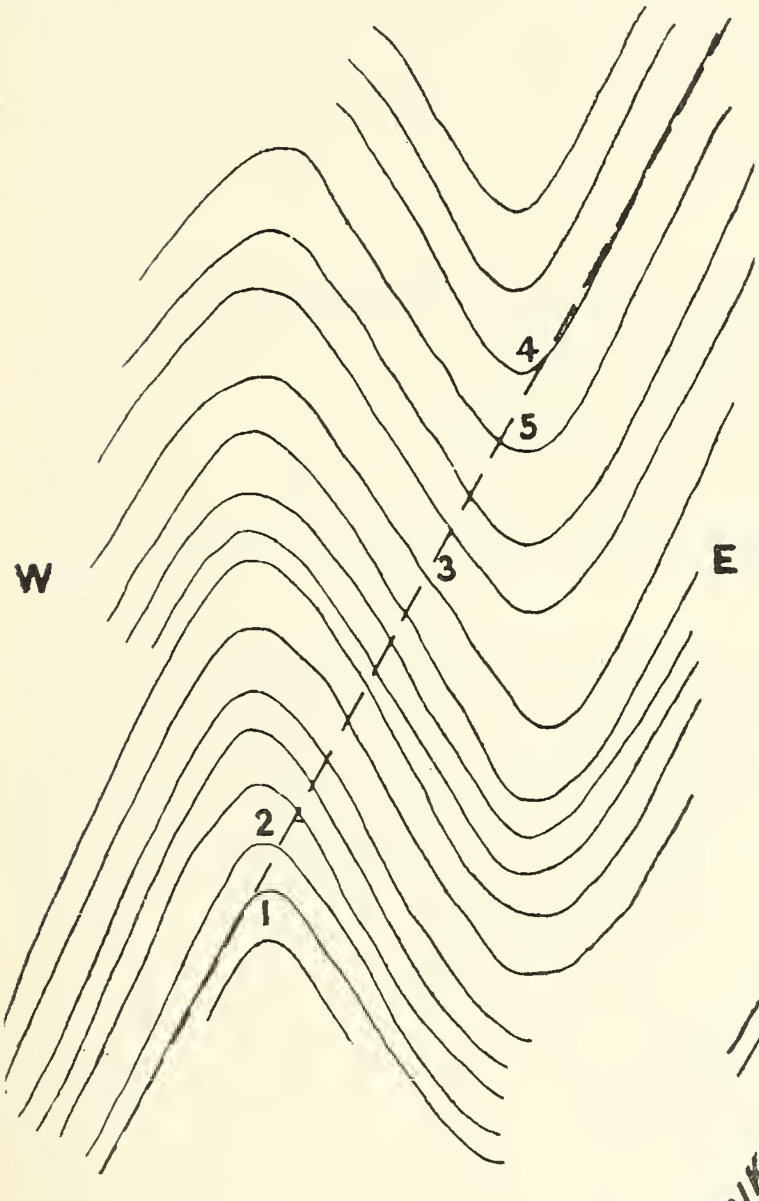


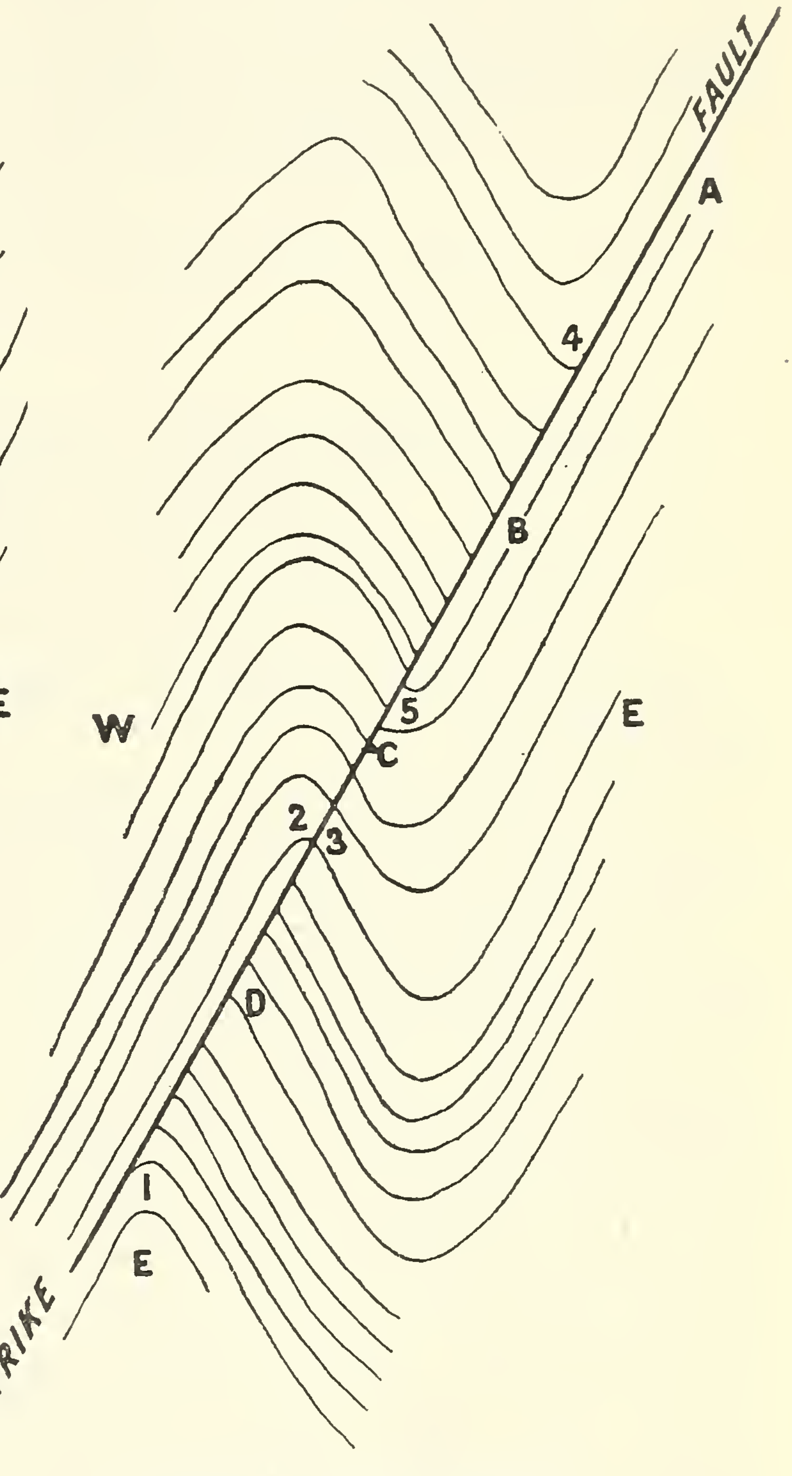
Fig. 16.

quartz reefs frequently occur which strike with the country-rocks, but dip across them for part of their course. Such reefs as occur at the Phœnix occupy lines of fault that strike with the beds, but that dip westerly. In part of their course they conform to the bedding planes of the country-rocks in dip. (*See* A.E., Fig. 18.) In part of their course they conform to the bedding planes on one wall, but cross them on the other wall—(*See* B.D., Fig. 18)—or they cut right across the bedding planes. (*See* C., Fig. 18.)



Section of Folded Beds before faulting.

Fig. 17.



The same after faulting.

Fig. 18.

Frequently the quartz reefs occurring in such faults are of large size, and are often very productive of gold. Reefs of this class are common. They occur at Bendigo, Chewton, Castlemaine; at the Cumberland and Phœnix mine, Campbell's Creek; at the Cornish mine, Daylesford; and many other places.

Such faults in parts run with western country on both walls. The country-rocks are always dipping to west in such cases, and this class of fault may be termed western strike faults, for they strike with the beds and dip to west. In such cases the reefs in them may easily be mistaken for "legs," but they are only false legs, as there is no saddle reef attached to them, and they have quite a different origin.

As these faults reach centre-country—anticlinal or synclinal—the quartz reef, which may have been many feet across, often diminishes in size, and where it is between western walls on both sides may be only an inch or two thick.

The diagram (Fig. 17) represents an anticlinal and synclinal in corrugated strata. The dotted line in Fig. 17 indicates the line of fault along which fracture and movement will take place. Fig. 18 represents the same bit of country-rock fractured, and the portion on the western side of the fault as having glided upward along the fault line. The figures show corresponding points on Figs. 17 and 18. Lateral pressure appears to have caused the fracture and displacement.

[*Report sent in 1st September, 1905.*]

THE SPRING GULLY MINE, NEAR FRYERSTOWN.

(NO. 25 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

The shaft, which is sunk to a depth of 589 feet, though the water is up to 430 feet, is well placed, as centre-country is 70 feet to the west of it at the surface.

At the 200-foot level the cross-cut to the west is blocked; the country-rocks dip to the east as far as worked, showing that centre-country is to the west of the shaft, but the distance is not known.

At the 240-foot level, in the western cross-cut, centre-country is 62 feet west from the shaft. The cross-cut is extended to a total length of 122 feet, and ends in westerly "country." All the slate and sandstone has a most favorable appearance, and should be productive of gold; in fact, throughout the mine the country-rock has this character. At this level a westerly strike fault occurs, and along this, where it crosses the beds, a great development of quartz has taken place. This reaches as much as 30 feet in thickness, and is worked profitably. A level is driven to the south for 420 feet. All the country-rocks pitch to the south. At the end of this southern level, and in a cross-cut to the west, is centre-country, a well-formed arch; while 30 feet to the west from the centre is the quartz "leg" now being worked, which is giving excellent returns. The quartz is 1 ft. 3 in. thick, and rising over the saddle. The pitch of the country-rocks here is to S. at 15 deg.

In the first stope above the intermediate level below 240 feet, and south of the cross-cut, large spurs of quartz are being worked. Some of these spurs are several feet thick, and are giving good returns. Coarse gold occurs in them, and a piece weighing 18 dwts. was recently obtained. These spurs are all connected with a "back," that is considered the eastern "back" from the western "leg" that is being worked in the level above.

Country-rocks, dipping to east, occur in a western 60-feet cross-cut off the No. 3 level at 318 feet to the south of the shaft. Centre-country is near the end of the cross-cut.

At the 430-foot level there is a cross-cut 14 feet to the east of the shaft; thence a level has been driven for 100 feet to the north, and a cross-cut 45 feet to the west. All are in country-rocks dipping to the east. Centre-country is still further to the west.

At the 480-foot level the cross-cut to the west in centre-country is 100 feet to the east of the shaft, and at the 560-foot level it is 105 feet to the west of the shaft, so the manager informed me. These two levels were under water at the time of my visit.

A feature at this mine is the abundance of large bodies of quartz carrying gold that occur to the east of centre-country. Centre-country winzes have not been carried down through the mine, and so the chances of saddle-reefs have not been determined.

The mines at Spring Gully are in a most favorable belt of auriferous country. The alluvial workings follow up all the main and minor water channels right into the hills. The Spring Gully mine and the adjacent mines are on a well-formed anticlinal axis, and there is every reason to believe that if the mining here were conducted as at Bendigo, in search of saddle-reefs and their "legs," and for spurry country connected with the "backs," these mines would be very profitable to work, and would also be likely to have a very extended life.

If suitable arrangements can be entered into with this company, I would strongly advise vertical boring from the bottom cross-cut to the west, so as to intersect saddle-reefs. Whether boring is done or not, these mines should have their shafts sunk deeper, with the object of exploring the country at greater depths. All the features in this neighbourhood point to this as being probably a very rich field for quartz-mining enterprise.

Owing to the removal of auriferous quartz too close to the shaft, damage has been done, and the shaft rendered insecure. It is doubtful if it could be depended upon, as this mine can look forward to great depths below the present bottom level that will have to be explored.

I would recommend that from the bottom cross-cut to the west a drill-hole, inclined to the west at about the angle disclosed in this mine that centre-country makes from the vertical, should be put down in centre-country. At the surface centre-country is about 70 feet to the west of the shaft. At 560 feet centre-country is 105 feet to the west of the shaft.

Before any bore-hole is started, I should like to see the bottom levels. In the event of a bore-hole being successful, it would affect, not only the group of mines now at work at Spring Gully, but the whole anticlinal line would be benefited, and probably adjacent lines as well.

[*Report sent in 4th September, 1905.*]

SOME GOLD-MINES AT BERRINGA.

(NO. 26 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

During the progress of his geological survey at Berringa, Mr. W. Baragwanath, junior, found that saddle-reefs were being worked at three of the mines there, and that, although the true nature of these reefs was recognised by Mr. Robert F. Bryant, the manager of the Kangaroo mine, their significance was not generally recognised.

In company with Mr. Baragwanath I have inspected the three mines, and fully confirm his determination.

KANGAROO MINE.

At the Kangaroo mine, over which we were shown by Mr. Bryant, saddle-reefs have been worked for the last eighteen months, and Mr. Bryant has extended these workings. The Kangaroo Company holds a tribute over 500 feet in length by 400 feet in depth of the Williams Fancy lease, at the northern end, and its operations extend into this ground.

In the No. 3 level of the Kangaroo shaft, which is 225 feet from the surface, and 800 feet south from the shaft, in the tribute portion of the workings in the stopes, 20 feet above the level, there is well-formed centre-country (anticline), and a saddle-reef measuring 10 feet across the saddle and 10 feet high from the cap of the saddle to the cap of the reef. This quartz is all sent to the crushing machine, and is very profitable to work. The general pitch of the reef is to the south, so that this same reef should be found at a deeper level by cross-cutting west from the Williams Fancy shaft. There is another saddle-reef, 1 ft. 6 in. thick, carrying excellent quartz, 23 feet below the 10-foot saddle reef; while 9 feet above this one is a small saddle-reef, 3 inches thick, but profitable to work. These three saddle-reefs are south of a cross-course, striking N.E., and dipping to S.E. at 5 deg. At the cross-course, and to the west of No. 3 level, a small saddle-reef, 8 inches thick, is disclosed. This has been driven on for 20 feet to the north. The pitch is to the south, and the quartz is payable. This is the only attempt that has been made to work the saddle-reefs above the No. 3 level, and north of the cross-course.

The No. 4 level is 90 feet below the No. 3 level. To the north of the cross-course, and within the Kangaroo lease, is a cross-cut to the west of the shaft, and 700 feet along the level, to the south. Centre-country occurs 70 feet to the west along this cross-cut. It has two well-formed saddle-reefs—the top one 1 ft. 3 in. thick, and the under reef 6 inches thick. The quartz of both reefs pays well for extraction.

In the same level, 400 feet south of the shaft, and 21 feet west of the cross-cut, in a rise 18 feet above this level, there is a sandstone saddle, pitching to the south. The saddle-reef is 8 feet thick and 26 feet wide across the saddle, with slate over the reef. Taken in a face, this quartz yields about 6 dwts. of gold per ton, and is very profitable to work.

In this mine the country-rocks consist largely of very favorable-looking slate beds. As these occur along the anticline, they are lower down in the series than the thick sandstone and olive-green slates that form such a characteristic feature in the country worked to the east of centre-country from Berringa to Scarsdale. These slates along the anticline are more favorable for gold than the sandstone, in which most of the mining has hitherto been done. As regards the horizon of the Berringa beds, all is uncertainty. Probably they belong to a horizon higher than the Bendigo zones. Until some fossils are discovered, or some other link obtained, the proper position of these beds in the miles of thickness of Ordovician rocks must remain problematical.

BIRTHDAY TUNNEL MINE.

In the No. 3 level, and north of the cross-course, centre-country is disclosed. A saddle-reef is being worked 400 feet north of the shaft, 30 feet south, and 50 feet above the level in the stopes. This reef is 30 feet across the saddle, and 6 feet high above the cap of the saddle. On the western side the leg is being worked down for some distance, the quartz varying from 6 feet to 8 feet in thickness. The whole of the quartz from the saddle-reef and from the leg is sent to the crushing plant, and averages 4 dwts. of gold per ton; this yields a profit. This saddle-reef is also worked on the northern side of a cross-course that intersects and displaces the country and the reef for about 40 feet to the west, going to the north. In the quartz, sulphides of iron, arsenic, lead, and zinc are common.

In the stopes, 40 feet below the No. 3 level and 50 feet north of the northern face of the level, the western leg is being stoped for a considerable length, and for a width of from 6 feet to 10 feet. The pitch is rapidly to the north. About 120 tons per day are being dealt with.

That saddle-reefs exist at Berringa is demonstrated, and their importance can scarcely be over-estimated. The survey was partly undertaken with the object of tracing out the course of the anticline through this group of mines. This has been done as far as possible. In addition, actual saddle-reefs are shown to exist, and, still further, every one of these reefs so far touched carries sufficient gold to make it very profitable to work.

Quite a different phase is put on the field, for its permanency is assured, as also the expansion of mining.

Saddle-reefs are being worked in the three mines, but the anticline goes through all the rest of the leases, and, as these saddle-reefs are highly auriferous, and occur in rapid succession, work should be at once undertaken to further explore centre-country by rises and winzes from the surface to the bottom levels, also to sink in search of them below the present depths, because it is known that they extend downwards for thousands of feet at Bendigo, and no doubt at Berringa also. The companies not working on centre-country should without delay cross-cut for it and explore it thoroughly, for along it is where the most permanent and the most profitable mining will be done.

These works may be undertaken with the fullest confidence, as the field is a permanent one, and with great resources awaiting development.

[*Report sent in 12th September, 1905.*]

SOME GOLD-MINES AT CHILTERN.

(NO. 27 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

THE GOLDEN BAR MINE.

This mine is situate about 2 miles east of Chiltern. The reef on which work is now being done is known as West's, and it was discovered and first worked in 1859. The present shaft is 345 feet deep, and this is below all the old workings—a poor record for the operations of 45 years, though, of course, the mine has not been worked for the whole period. Hauling and pumping machinery are being erected, so that sinking operations can be pushed on.

There are two levels open—one (No. 1) at 242 feet, and the other (No. 2) at 345 feet. On No. 1 level, and 29 feet in the cross-cut to the east, is the Golden Bar reef. The country-rocks and the reef also dip to the east. The reef stops at the level, and appears to be conformable to the country. Centre-country appears to be near the shaft. A small "leg" of quartz, 4 inches thick, occurs, dipping to the west. At the end of the shaft, and a little further to the east, is a thin leg, dipping to the east. At 65 feet in the cross-cut to the west a leg has been worked upwards. The quartz here has the laminated structure that is usual where the quartz vein is between the bedding planes of the country-rock, and it contains payable gold. At the end of the western cross-cut (100 feet from shaft) is a fold, and in this, at the lower level, and above No. 1 level, spurs of quartz have been worked. In the stopes over the level a width of from 5 feet to 10 feet of mixed quartz and slate is being crushed, with payable results. Sixteen feet to the west of the shaft, in the western cross-cut, is a small leg of quartz, 4 inches thick, that yields 1 oz. of gold per ton, so the manager informed me. The dip of the country-rocks is nearly vertical to the leg at 65 feet; there the beds are much contorted. Faults occur in this, as well as in the lower level.

On the No. 2 level, at 50 feet to the east of the shaft, the country-rocks dip to the east. A fault, dipping to the west, crosses the level. Quartz, 2 feet thick, occurs. Above the fault the pitch of the country-rocks is to the north. In the northern level the leg rises and bends over, forming a saddle-reef. The eastern leg averages 3 feet of quartz and country-rock that is payable. The pitch of the saddle is to the north. In the western cross-cut, off the southern level, and 40 feet above, in the stopes, spurs are being worked in centre-country.

At the intersection of the cross-cut and No. 2 lode level centre-country occurs. Going southwards from this point is a well-formed lode, 1 foot thick, between smooth, regular walls, the quartz being payable. This is the western leg of the saddle. The corresponding eastern leg, which dips to the east at about 85 deg., is followed down below the level for 50 feet in a winze; it consists of payable quartz. Above the level this leg is worked for a height of 60 feet.

A characteristic of this mine is that thin but rich quartz veins, that conform to the strata, occur, and these partake of the foldings of the strata, and appear to be payable wherever found. Besides these "legs," there are also present spurs, containing sufficient gold to be profitably mined. Very little cross-cutting has been done so far, but the cross-cuts should be extended, and no doubt other quartz reefs would reward the quest. To the west of the present operations two lines of reef have been worked, evidently with good results. The structure of the mine is complicated, and it will be necessary to have a survey and plans made of the whole group of mines, so as to elucidate their structure and the conditions under which auriferous quartz occurs. Such a survey should greatly assist in the development of these mines, and should inspire confidence in them by making the facts known.

The group of leases, on most of which work is being done, are, beginning at the northern end—

1. The Robbie Burns.
2. The Golden Bar, No. 1.
3. The Golden Bar Extended.
4. The Golden Bar.
5. The Golden Bar South.

TANNER'S WORKINGS.

Tanner's old workings are about 20 chains a little east of south from the Golden Bar shaft. Payable quartz is reported to have been obtained here.

ALL NATIONS WORKINGS.

About half-a-mile to the south of the above shaft, and in the Golden Bar South lease, are the All Nations workings, where three parallel reefs, dipping to the west, have been extensively worked. These are "legs," and indicate that centre-country is further to the east, and the shaft should be sunk near centre-country to work this ground systematically.

CHARLIE BRUHN'S REEF.

About 10 chains still further to the west is Charlie Bruhn's Reef, dipping to the east, from which some rich small patches of quartz were extracted. This reef is between the bedding planes of the country-rocks.

The rocks along the tract occupied by the above mines consist of Ordovician slates and sandstones, evidently belonging to a very productive zone, as the alluvial workings in the neighbourhood were rich in gold.

Both to the east and west of the Golden Bar mine auriferous reefs were worked, and, from the nature of the case, cross-cutting will be the best way to develop the mine. The other mines in this group all appear to be on the same belt of country as the Golden Bar mine.

THE ROBBIE BURNS MINE.

This mine is situate 1¼ miles north-east from Chiltern. The depth of the shaft is 333 feet. The beds dip to the west at 75 deg., while the reef dips to the east at 80 deg. From the bottom level to the surface this reef is intact. The pitch of the country-rocks is to the south, near the northern end of the northern level. The total length of this level is 210 feet. The lode and spurs also are exposed in the northern face.

The southern level is 108 feet in length to the western cross-cut, which is 130 feet long, in massive sandstone beds, dipping at 40 deg. to the west. In the face quartz spurs show that this cross-cut should be extended a little further to the west, and it should certainly be extended eastwards. The end of the southern level is 242 feet from shaft. Near the southern extremity of this level quartz is being stoped. Besides the reef, 3 to 4 feet thick, which crosses the beds, and dips to the east, there is a small but rich "leg" of quartz that dips to the west. These two bodies of productive quartz intersect each other in the level. This leg is about 2 inches thick, and shows gold freely. Probably similar conditions to those present in the Golden Bar mine will be found to prevail in this mine. Cross-cuts to the east are much required, and this is the best direction in which to open up the mine.

In the Chiltern district there are great numbers of reefs that yielded good returns many years ago, and which are now abandoned. Probably work has ceased in many of them through those in charge of the mines failing to grasp the peculiar conditions under which the auriferous quartz occurs. The beds of the Ordovician series around Chiltern present all the features of highly auriferous country. The alluvial workings yielded gold in abundance, and, so far as worked, the reefs gave excellent results. There appears to be a wide scope for mining enterprise in this neighbourhood.

[*Report sent in 3rd October, 1905.*]

THE GOLDEN EAGLE LODE, COOKIMBURRA, NEAR BARNAWARTHA.

(NO. 3 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

Messrs. Boucher and Ashe have continued the sinking at this locality, which is about 3 miles south-east of Barnawartha, and they have developed an interesting occurrence. The shaft is now 31 feet deep, and at the bottom there is a peculiar granitic rock that, for a width of 12 feet, is impregnated with sulphides of copper, iron, and lead. In some places the sulphides segregate into small rich patches. The ores here bear a strong resemblance to those occurring throughout the metamorphic area, and this is the extreme north-western locality in which such ores have been discovered. An average sample of the ore was collected for assay. This has been assayed by Mr. Bayly, at the Mines Department Laboratory, and the following results obtained:—Gold, 2 dwts. 14 grs., per ton of sample; silver, 12 dwts. 2 grs., per ton of sample; lead, 5 per cent.; copper, trace; arsenic, large amount.

[*Report sent in 3rd October, 1905.*]

THE OCCURRENCE OF GOLD IN OLIVER'S PADDOCK, NEAR KILMORE.

(NO. 28 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

About 5½ miles, W. 30 deg. N., from Kilmore some work has been done by the Kilmore Prospecting Association in the above paddock. Gold was first obtained by washing loams below the road. Some shallow holes were sunk also, but no colours of gold were obtained more than a few inches below the surface. By means of loaming, gold in the surface material was traced across the road and into Oliver's paddock, when the source of the gold was discovered. It is a fault line, striking E. 25 deg. N., cutting through the Silurian mudstones nearly vertically. In this fault line there is a little quartz that ranges up to as much as 1 inch in thickness, and which carries a little gold. On the western side of the fault, or "wall," thin auriferous quartz veins extend nearly at right angles into the mudstones. They are also almost vertical, and carry a little gold. Other thin quartz veins parallel to the fault are not auriferous. By means of surface trenches the wall or fault has been traced for about 3 chains, and its direction leads towards an old shaft that appears to have been sunk on a similar thin auriferous quartz vein to a depth of 40 feet. In the gully, north-east from this shaft, which was apparently sunk 20 or 30 years ago, are a few workings for alluvial gold. Evidently some was obtained, but not in profitable quantities. About two chains south of the old shaft is a remarkable conglomerate apparently of Silurian age. The pebbles are much sheared. This conglomerate occurs over a wide tract of country, and holes have in many cases been sunk in it in the search for alluvial gold.

The mudstones have a favorable appearance for gold, and had the fault been continuous downward, it would have been worth following; but at a depth of 12 feet, so the prospector informs me, a nearly horizontal fault occurs, which has cut off everything above. There is nothing to determine the extent of the displacement, so that there is not much encouragement for continuing present operations. The Association deserves much credit for the manner in which the indications of gold obtained near the flat were followed up, and the source determined.

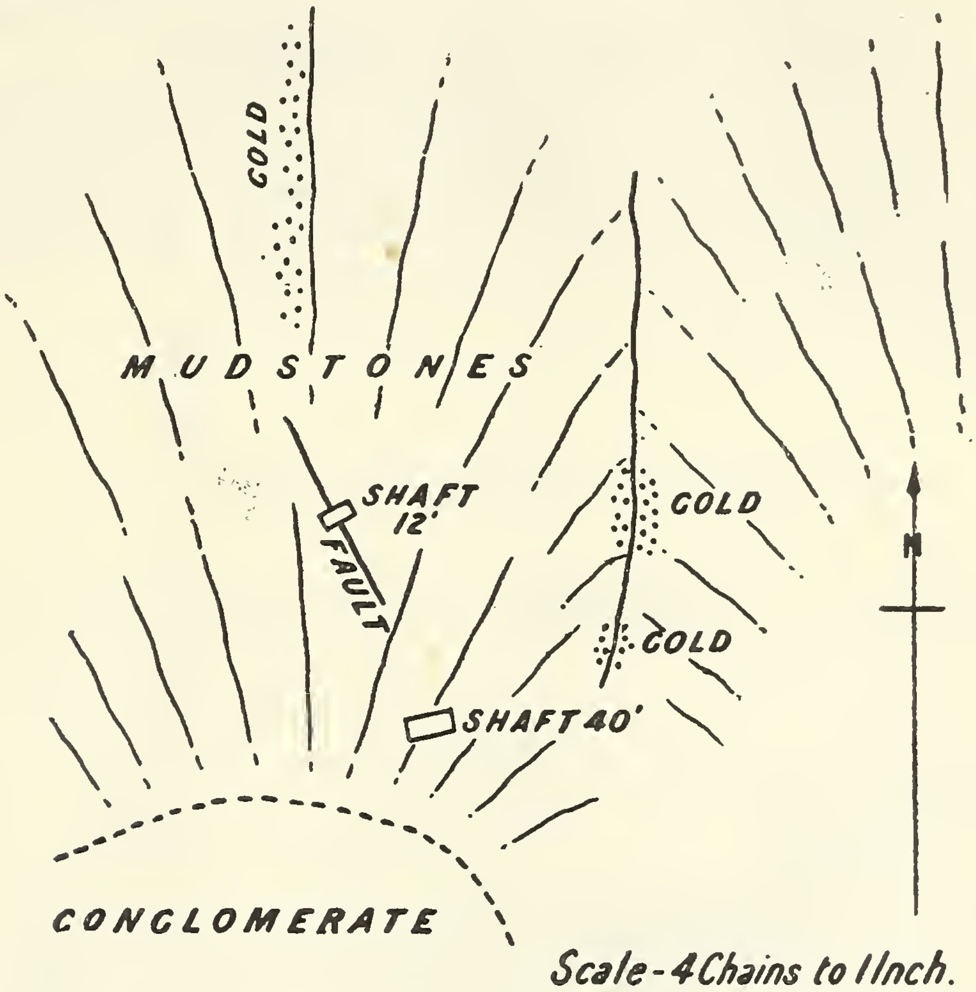


FIG. 19.

[Report sent in 13th October, 1905.]

THE KILMORE GOLD DIGGINGS.

(NO. 28 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

LARRY BOURKE'S REEF.

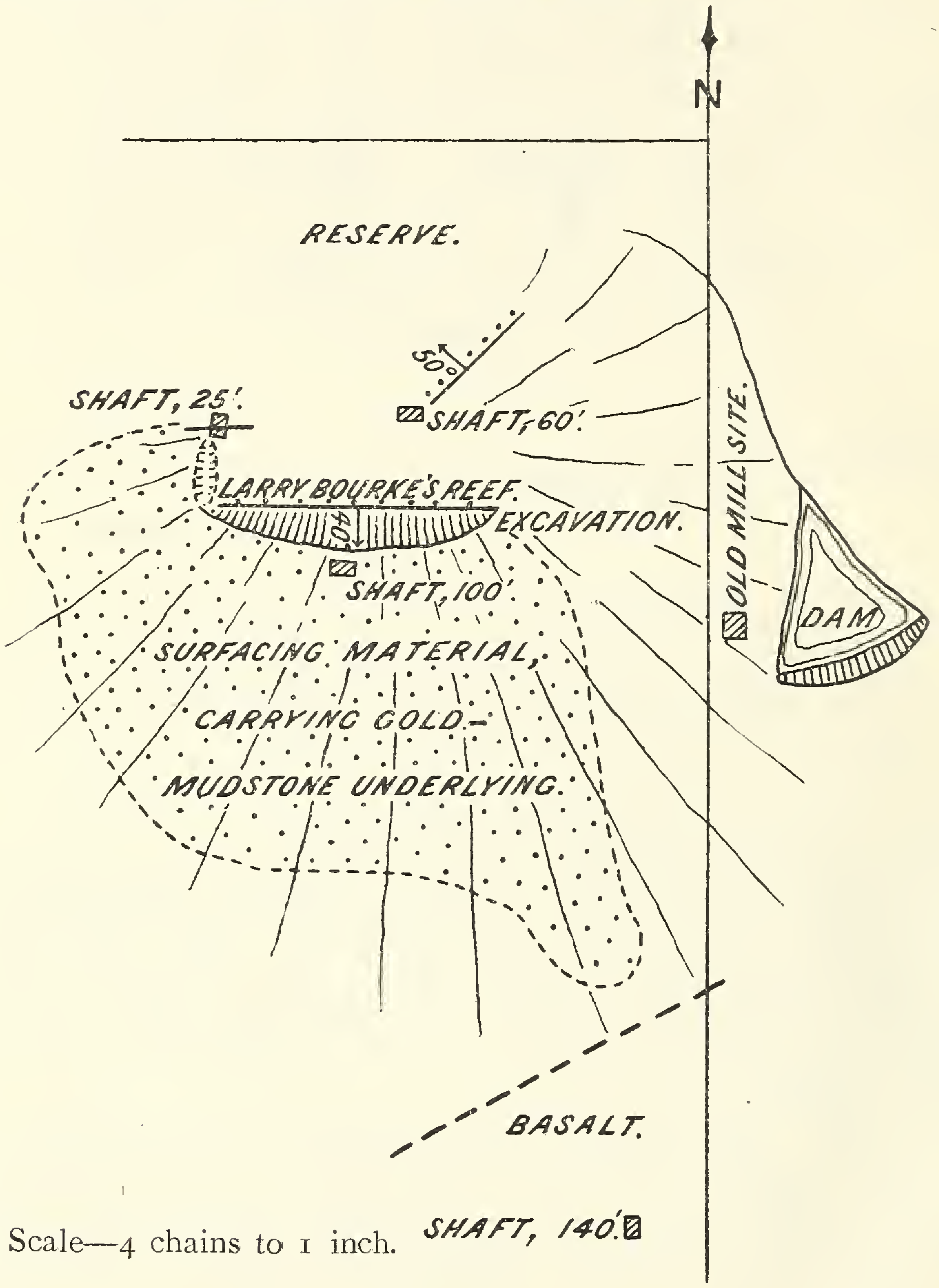
About 6 miles from Kilmore, in the parish of Goldie, and on a mining reserve, is where Larry Bourke's reef was formerly worked. The rocks consist of soft pink and yellow mudstones, with strike a little west of north, and dip to west at from 40 deg. to 60 deg. The westerly dip continues in the old excavations right up to their eastern limit, but there are indications that centre-country may not be much further east. The workings are on a rise.

Larry Bourke's reef strikes E. and W. and dips to S. at an angle of almost 40 deg. The outcrop is 4½ chains long and it has been worked on the dip to a depth of 100 feet. A shaft has been sunk on the northern side, so as to cut the reef on the dip. It is 100 feet deep, but apparently little work was done from it. A very extensive excavation exists along the northern side of where the reef cropped out, caused by the removal of considerable quantities of crushing material, and it is reported that very rich returns were obtained. From the reef southward a large area has been "surfaced" for the loose gold. About 11 chains in a south-easterly direction from the shaft, a deep shaft (140 feet) has been sunk in alluvial ground, and through basalt. The washdirt was worked to a small extent—it was reported with good results—but the water was very heavy, and work was discontinued.

Besides Larry Bourke's reef (the thickness of which was not obtainable), some small quartz veins were formerly, or are now, being worked. One running about E. and W. is being prospected by Mr. John Evans.

who has sunk a shaft 25 feet deep on it. The quartz ranges from 1 inch thick down to ¼ inch; it carries a little gold. Another, having a N.E. strike, and dip of 50 deg. to N.W., is being worked on the top of the rise. A shaft, 60 feet deep, was formerly sunk on the line of this quartz vein.

All the appearances indicate that profitable mining was carried on here, and that a very considerable quantity of material was crushed. The rocks are of most favorable appearance, and it is probable that other auriferous veins would be discovered if systematically searched for. The locality is well worth the attention of prospectors. At present, there are but two or three men engaged in mining operations.



Scale—4 chains to 1 inch.

Fig. 20.

[*Report sent in 13th October, 1905.*]

GOLD-MINING AT GOLDIE, NEAR KILMORE.

(NO. 28 ON LOCALITY MAP.)

By E. J. Dunn, F.G.S., Director, Geological Survey.

Six miles from Kilmore, on the road to Mount William, and half-a-mile back from the road, is the mine formerly worked by Messrs. Watson and Patterson, in private property.

The rocks here are harsh-looking grey sandstones, which, on being broken, are seen to contain much arsenical pyrites disseminated through them.

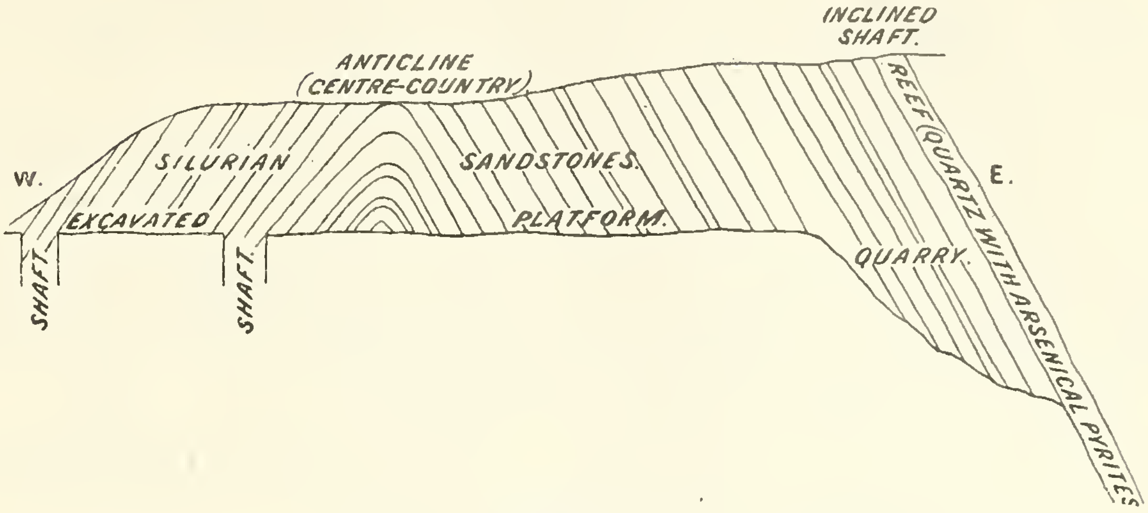


FIG. 21.

Centre-country, as an anticline, is exposed in the workings at the surface. At 64 feet to the east from centre-country a leg has been worked down to a depth of 120 feet on the dip (E.), and from this a considerable amount of work has been done underground, and some thousands of tons of crushing material extracted, as indicated by the tailings heap a little lower down. At 12 feet to the west of centre-country, a shallow shaft has been sunk, and another shallow shaft still further to the west. Southward from the shaft the workings are said to have been extended for about 300 feet. On the western side of centre-country the dip is 55 deg. W.; on the eastern side the dip is about the same to E. The strike of the country-rocks is N. 10 deg. W. It is reported that crushing material was taken for as much as 30 feet in width in some places, and that the yield was about 9 dwts. of gold per ton; but accurate records are not available.

This locality appears to be a promising one, and a shaft sunk near centre-country, with cross-cuts, is required to properly test the ground for saddle reefs and "legs."

A sample of concentrates (arsenical pyrites) obtained from a little heap on the ground, on assay, gave—

Gold, 9 dwts. 3 grs. per ton of sample.
Silver, a trace.

A piece of quartzose sandstone, with arsenical pyrites, disseminated through it, on assay, gave—

Gold, a trace.
Silver, nil.

[*Report sent in 14th October, 1905.*]

REPORTS ON GRAPTOLITES.

By T. S. Hall, M.A., Melbourne University.

From a site, 100 chains distant, on a bearing of E. 35 deg. 53 min, S. from the middle of the Painswick Railway Station Ground, near Dunolly. (No. 29 on Locality Map.)

(Nos. 791—861. Collected by Mr. W. H. Ferguson.)

The greater number of these are quite indeterminate, and in many cases I am not sure that the blurred markings represent graptolites at all. In not a single case is the material such that a specific determination can b made with certainty, and in very few instances can even the genus be definitely asserted. Still, on looking at the collection as a whole, I feel almost certain that the rocks belong to the Lancefield series. There are no specimens present that would contradict this opinion; not one that might not represent a Lancefield form.

Hitherto no graptolites have been found so far to the westward. In 1898, Mr. Thomas Smith sent me a small series of graptolites from Campbelltown, which lies to the east of the Dunolly strike. These were typical Bendigo forms. It now appears that these are succeeded to the westward by fossils belonging to lower zones. Far to the south on the Moorabool and Leigh Rivers, graptolites have long been known, but they are all higher in the series though still Lower Ordovician.

The discovery of these graptolites in such unfavorable country by Mr. Ferguson is of very great importance, and it is to be hoped that better material will be forthcoming in the near future.

The following are the particulars of the specimens:—

?*Bryograptus* or *Dendrograptus*, Nos. 803, 813, 814, 828, 849, 858.
?*Clonograptus*, the bifurcation of a large species, or, perhaps, *Dicranograptus cf. ramosus;* No. 812.
?*Clonograptus*; Nos. 814, 815, 819, 825, 838, 841 (in this specimen the centre is shown and fifteen short branches. It is not *Loganograptus*.), 845, 846.
?*Tetragraptus decipiens;* Nos. 813, 856 (almost certain), 858.
Dichograptid, ? genus; No. 795.
Sponge spicules; No. 800.
?Brachiopod; No. 827.

The remaining specimens are indeterminate.

University, Melbourne, 31st October, 1905.

Nos. 862-899.

Quarter Sheet No. 34 *S.W.*

Indeterminate, No. 862.

Quarter Sheet, No. 22 N.W. North-west of Mount Easton. (*No. 31 on Locality Map.*)

Nos. 863-866 (collected by Mr. Wm. Baragwanath, junr.).

Dicranograptus ramosus, var. *semispinifer;* No. 865.
Diplograptus ingens; Nos. 863, 866.
Climacograptus sp.; No. 866.
Indeterminate; No. 864.

Similar forms have previously been reported on from this locality.

Railway Quarry, near 4½ mile post, Railway Viaduct, Ingliston. (*No.* 30 *on Locality Map.*)

(Nos. 867-884. Collected by Mr. A. E. Kitson.)

Tetragraptus serra; Nos. 869 (?), 870, 876 (?).
Phyllograptus, sp.; No. 876.
Didymograptus caduceus; No. 869 (?).
Didymograptus, sp. nov., a large form; Nos. 869, 879, 881, 884.

The others are indeterminate. Like all the other graptolites hitherto found in the Bacchus Marsh District, these belong to the Castlemaine series. The large new *Didymograptus* occurs near Yapeen and Woodend, with the same associated forms; so that the three localities are about on the same horizon.

Ingliston, 42¾ *M., Railway Cutting.* (*No.* 30 *on Locality Map.*)

(Nos. 885-899. Collected by Mr. A. E. Kitson.)

Didymograptus caduceus; Nos. 891 (?), 893 (large), 897 (large).

The remaining specimens are indeterminate.

The rocks belong to the Castlemaine series.

University, Melbourne, 31st October, 1905.

A site, 100 *chains distant, on a bearing of E.* 35 *deg.* 53 *min. S. from the middle of the Painswick Ralway Station Ground, near Dunolly.* (*No.* 29 *on Locality Map.*)

(Nos. 900-966. Collected by Mr. W. H. Ferguson.)

The following forms occur:—

Tetragraptus decipiens T. S. Hall; Nos. 920, 925, 927 (?), 934.
? *Clonograptus magnificus* (Pritchard); Nos. 900, 926, 927, 931, 935, 942, 943.
Clonograptus cf. rigidus var. *tenellus* Linnars. Nos. 929, 941.
Clonograptus sp.; Nos. 915 (?), 918, 919, 923 (?), 940 (?), 945.
Bryograptus sp.; Nos. 930 (?), 932 (?), 938 (?).

The remaining slabs, for the most part, show traces of graptolites on them; these are all indeterminate, though all might belong to the Lancefield series. In the light of the evidence afforded by the next localities dealt with, there can be no doubt that the guarded reference of the Dunolly graptolites to Lancefield age in my last report was correct.

Dunolly. (*No.* 32 *on Locality Map.*)

(Nos. 967-988. Collected by Mr. W. H. Ferguson.)

The following identifications were made:—

Tetragraptus decipiens; Nos. 968, 973 (?), 977.
Clonograptus rigidus var. *tenellus;* Nos. 977, 978.
Clonograptus sp.; Nos. 970 (?), 974, 975 (?), 988 (?).

The remaining slabs mostly contain graptolites, but their state of preservation is too poor for identification. Some of the slabs seem to indicate crustacea, allied to *Rhinopterocaris.*

A site, 242 *chains S. from the S.E. corner of Allotment* A18, *Parish of Moliagul, near Dunolly.* (*No.* 33 *on Locality Map.*)

(Nos. 989-1010. Collected by Mr. W. H. Ferguson.)

The following occur:—

Tetragraptus decipiens; Nos. 990, 998, 999, 1002.
Didymograptus pritchardi T. S. Hall; Nos. 992, 994, 1010.
Clonograptus magnificus; Nos. 993 (?), 1004 (?).
Clonograptus rigidus var. *tenellus;* Nos. 997, 1001.
Dictyonema macgillivrayi T. S. Hall; No. 989.

The remainder are indeterminate.

The occurrence of a large part of the hydrosome of *D. macgillivrayi* and of some well-preserved specimens of *Clonograptus rigidus* var. *tenellus* definitely fixes the age of the containing beds as Lancefieldian.

Daylesford Gold Mine Mullock Tip. (*No.* 8 *on Locality Map.*)

(Nos. 1013, 1014. Collected by Mr. Wm. Baragwanath, junr.)

Tetragraptus fruticosus; No. 1014.
Indeterminate; No. 1013.

Age—Probably Bendigonian.

Daylesford. Shaft ¼ mile south of New Cornish Company's shaft. (No. 8 on Locality Map.)

(Nos. 1015, 1016. Collected by Mr. Wm. Baragwanath, junr.)

Dydymograptus cf. extensus; No. 1015.
Didymograptus caduceus; No. 1016.

The beds belong to the Castlemaine series.

Daylesford. Northern side of Jubilee Lake, ¼ mile east of the Railway Station. (No. 8 on Locality Map.)

(Nos. 1011, 1012, 1017-1020. Collected by Mr. Wm. Baragwanath, junr.)

Didymograptus caduceus; Nos. 1017, 1018, 1019, 1020.
Dichograptus octobrachiatus (?); No. 1012.

The beds belong to the upper part of the Castlemaine series.

Daylesford Gold Mine Mullock Tip. (No. 8 on Locality Map.)

(Nos. 1021-1030. Collected by Mr. Wm. Baragwanath, junr.)

Didymograptus bifidus, J. Hall; No. 1025.
Phyllograptus typus, J. Hall; Nos. 1023 (?), 1024.
Tetragraptus bryonoides, J. Hall; No. 1028.
Tetragraptus serra, Brong.; No. 1029.
The remainder are indeterminate.

The beds are referable to the Wattle Gully subdivision of the Castlemaine series, and come immediately above the Bendigonian.

University, Melbourne, 30th November, 1905.

From near Dartmouth, 4 chains from battery in Gully, Green's Creek. (No. 34 on Locality Map.)

(No. 1032. Collected by Mr. E. J. Dunn.)

Diplograptus cf. foliaceus, Murchison.

The poor state of preservation of the specimen prevents its accurate determination. The rocks are probably Upper Ordovician.

Bald Hill Quarry, Parish of Kangerong, east of Dromana. (No. 35 on Locality Map.)

(Nos. 1033-1044, 1046, 1047. Collected by Mr. A. E. Kitson.)

Didymograptus sp. indet.; No. 1034.
Didymograptus cf. extensus, J. Hall; No. 1038.
Tetragraptus pendens, Elles; No. 1033.
Tetragraptus cf. quadribrachiatus, J. Hall; Nos. 1034 (?), 1036, 1044 (counterpart of 1036), 1046 (?), 1047 (?).
Clonograptus sp.; No. 1037 (?).
Indeterminate; Nos. 1035, 1039, 1040, 1041, 1042, 1043.

Age—Bendigonian.

South-eastern portion of Jamieson's Special Survey, Parish of Kangerong. (No. 36 on Locality Map.)

(Nos. 1045, 1048, 1049. Collected by Mr. A. E. Kitson).

Tetragraptus approximatus, Nicholson; Nos. 1048 and 1049 (counterparts).
Tetragraptus fruticosus, J. Hall; No. 1045.
Clonograptus sp.; No. 1048 (?).

Age—Bendigonian.

University, Melbourne, 19th March, 1906.

NEWER SILURIAN FOSSILS OF EASTERN VICTORIA, PART I.

By Frederick Chapman, A.L.S., &c., Palæontologist to the National Museum, Melbourne.

THE FOSSILIFEROUS SANDSTONES AND CONGLOMERATES OF THE UPPER THOMSON AND ABERFELDY RIVERS, MOUNT BAW BAW. QUARTER SHEET No. 22 N.W. (NEW SERIES).

BELL'S TRACK. (NO. 37 ON LOCALITY MAP.)

Lithological Characters.—Specimens Nos. 5 to 26, from Bell's Track, are, generally speaking, fine-grained pale yellowish to brown sandstone. The rocks contain a little white mica and a few sub-angular quartz pebbles; they are highly fossiliferous, but the fossils are fragmentary and badly preserved, occurring chiefly as hollow casts with a thin limonitic stain.

Fossil Determinations.

Specimen Number.	Fossils, with Remarks thereon.
10, 15, 25 ...	Crinoid columnars, 4 mm. in diameter; articular surface coarsely, radiately striate in the peripheral zone.
11, 12, 16 ...	Crinoid columnars, 9 mm. in diameter, approximately; articular surface radiately striate and granulate.
7, 9, 18, 21 ...	(?) *Strophomena* or (?) *Stropheodonta.* Fragments only.
17	*Chonetes cresswelli*, Chapm.
5	*Chonetes* sp. Referable to the section "plicosæ," of which *C. mucronata*, J. Hall is an example.
8	*Chonetes* sp.—*cf. C. acutiradiata*, J. Hall; or perhaps young example of *C. cresswelli.*
14	(?) *Camarotœchia* sp.—*cf. C. decemplicata*, Sow. sp.
7, 12, 16, 19, 20, 22, 23, 24, 25	Fragments of brachiopods, indeterminable.
24	*Spirifer* sp.
19	(?) *Nucula* sp. An internal cast, showing some of the teeth of a taxodont hinge-line.
10, 15, 16, 20 ...	Fragments of trilobites—indeterminable.
5	(?) *Proetus* sp. Portion of a cephalon.

WATERLOO GULLY, THOMSON RIVER. (NO. 38 ON LOCALITY MAP.)

Lithological Characters.—Nos. 27 and 28 are fossiliferous conglomerates, with included pebbles of quartz, and chips of indurated mudstone. The rock shows a distinctly bedded structure, and it is largely composed of remains of crinoids, brachiopods and monticuliporoids, chiefly as casts in a limonitic material.

Nos. 29 to 38 are fossiliferous sandstones, with numerous remains of crinoids and brachiopods. The rock is well stratified, and usually shows signs of current-bedding. It is darker in colour than the preceding (Nos. 27, 28), and shows some quartz and numerous fragments of shale. Some of these rocks have undergone a certain amount of thrusting, as shown by their sheared character, and distortion of the included brachiopods.

The nature of these rocks points to their having been deposited in very shallow water.

Fossil Determinations.

Specimen Number.	Fossils, with Remarks thereon.
27	A ramose monticuliporoid, allied to *Monotrypa.*
27-38	Crinoid remains, chiefly as casts of stem-joints.
30	Crinoid columnars, similar to No. 11.
30, 35, 38 ...	*Fenestella cf. australis,* Chapm. Fragments of casts.
37	*Orthis* sp.; like *O. plicatella,* J. Hall, but smaller, and with more numerous costæ.
29, 30	(?) *Rhynchotrema* sp.
36	(?) *Spirifer* sp. A fragment.
28	(?) *Trematospira* sp.

O'KEEFE'S GULLY, ABERFELDY RIVER. (NO. 39 ON LOCALITY MAP.)

Lithological Characters.—Nos. 39 to 57 are a coarse-textured fossiliferous sandstone, often conglomeratic, and with included shaly fragments. The fossils are numerous, but imperfect, and chiefly in the form of casts.

Fossil Determinations.

Specimen Number.	Fossils, with Remarks thereon.
39, 47	A rugose coral, probably allied to *Lindstrœmia.*
41	(?) *Monotrypa* sp.
44, 50, 51, 52, 54, 57	*Cladopora* sp. Casts of the corallites of a moderately stout, and irregularly ramose form, in dark-brown, limonitic material. This fossil is practically identical with the specimen recorded by Prof. McCoy,[1] as allied to *Cladopora fibrosa,* J. Hall. It seems to be a well distributed form in the younger series of the Victorian Silurian strata. It differs from Hall's species in having a shorter habit of growth, so far as I have seen; and the calicular tubes continue farther down the central axis as a parallel series. The mural pores, seen as small processes on the sides of the tubes in these casts, are large and conspicuous. In some respects this fossil approaches *Striatopora,* especially in having slightly expanded calicular orifices.
47	A cylindrical monticuliporoid.
49, 50, 54 ...	A small digitate (?) stromatoporoid, bearing some resemblance to *Amphipora.* Casts only.
39	Crinoid columnars, resembling No. 11.
40, 41, 42, 43, 44, 45, 47, 50, 52, 54, 55, 56, 57	Crinoid columnars.
53	*Fenestella* sp. Cast of a fragment.
41	*Orthis* (*Dalmanella*) *testudinaria,* Dalman.
51	(?) *Orthis* (*Dalmanella*) *testudinaria,* Dalman.
46, 47	(?) *Orthis* sp.
42	*Chonetes* cf. *robusta,* Chapm.; with a somewhat produced cardinal area.
45, 48	*Atrypa reticularis,* Linn. sp. Impressions of shell.

---

[1] Progress Report, Geol Surv. Vict., No. V., 1878, p. 175.

Age of the Rocks (*Nos.* 5 *to* 57).—There can be very little doubt, from the presence of several characteristic fossils, and the general faunal aspect, that the series of specimens from the three foregoing localities are of Silurian (Yeringian) age. As is usual in the uppermost Silurian beds of Victoria, there is here present a fair number of forms elsewhere regarded as Devonian.

THE FOSSILIFEROUS LIMESTONES AND CONGLOMERATES OF THE THOMSON AND TYERS RIVERS AND MARBLE CREEK, GIPPSLAND.—(COLLECTED BY Mr. A. E. KITSON.)

Thomson River Limestones. (no. 40 on locality map.)

Lithological Characters.—The specimens from the Copper Mine, Thomson River, numbered 204-210, and 65, are compact, sub-crystalline, fossiliferous limestones. They are of a grey colour when freshly fractured, and weather to a rusty-brown on rough surfaces which have been long exposed. These limestones are principally of organic origin, and, owing to the preponderance of crinoid remains, are typical crinoidal limestones. The bright cleavage surfaces of the original crystalline components of the column and other portions of the crinoid-skeleton impart a crystalline appearance to this limestone, which is, however, different from the structure seen in highly metamorphosed or statuary marble, where the constituent grains do not show any outlines of organic fragments.

On the weathered surfaces of the Thomson River limestones, columns of a large form of crinoid are conspicuous, the diameter of the stems often measuring 13 mm. Microscopic sections have been made from Nos. 207 and 208 (slices Nos. 1019 and 1008), and these, on microscopic examination, yield further evidence of organic remains than can be obtained by a superficial inspection of the rock. Under the microscope it is seen that the cementing portion of the limestone is now in the condition of finely crystalline calcite. That the rock has undergone certain dynamo-metamorphic changes is well shown by the strong curvature of the rhombohedral cleavage developed in the calcitic plates composing the crinoid joints; and in a few cases the rock has been distinctly "sheared."

No. 207, in thin section, shows the rock to be largely of organic origin, crinoid remains being abundant; the whole is cemented by a finely crystalline calcitic paste, more or less impure, and occasionally graphitic. The only alteration this rock has undergone is a little secondary crystallization of the calcite, which tends to obscure the structures of the organic constituents. In the microscope slide of this rock the following organisms are present:—Numerous crinoid remains, carapaces of ostracoda (sub-oval in section), and an example of the genus *Fistulipora*.—(See Pl. II., fig. 3.)

The slice of No. 208 is also crowded with organic remains, chiefly crinoids, the other fossils present being rendered obscure by the large amount of shearing in the rock. The original cellular appearance characteristic of all echinodermal structure is only seen here and there as a minute stippling of dark particles. In both this and the former slide a small amount of crystalline quartz is seen disseminated through the rock; and where the crinoid plates have been fractured they show recementation by finely crystalline calcite (see Pl. I., fig. 1).

The slide of rock-specimen No. 65, exhibits very strikingly "shear" or schistose structure. A microscopic examination shows this limestone to contain numerous crinoid remains and carapaces of ostracoda, with an occasional pellet formed by the minute tubular organism, *Girvanella*. The crinoidal plates and ossicles form eyes, or lenticles, around which stream the finer, granular, calcitic particles (see Pl. I., fig. 2). A particularly interesting feature of this limestone is the inclusion of numerous flakes of biotite (black mica) and pale green chlorite, interlaminated with the calcite constituents; whilst here and there may be seen some contorted bands of tuffaceous fragments. This clearly suggests the outburst of tuffaceous andesitic ejectamenta contemporaneously with the deposition of the limestone, as illustrated, for example, by the calcareous organic tuffs forming in the proximity of volcanic islands at the present day.

FOSSIL DETERMINATIONS.

Specimen Number.	Fossils, with remarks thereon.
204 ...	Crinoid remains.
205 ...	Crinoid remains. In thin section this rock is seen to contain *Girvanella*, (?) *Alveolites*, and a stromatoporoid, with structure obscured by crushing and recrystallization.
206 ...	Crinoid remains.
207 ...	*Fistulipora* sp. (Pl. II., fig. 3). See description at end of report. Crinoid plates and ossicles, numerous. Ostracoda, probably a species of *Primitia*. This rock is more or less "sheared," and shows some biotite between the folia.
208 ...	Crinoid remains abundant (Pl. I., fig. 1).
209, 210 ...	Crinoid remains.
65 ...	*Girvanella* (Pl. I., fig. 2). See description at end of report. Crinoid remains. Ostracoda, apparently referable to *Primitia* (Pl. I., fig. 2).

SPECIMENS FROM TYERS RIVER. (NO. 41 ON LOCALITY MAP.)

These are numbered from 58 to 64 (including 64A), 66 to 77 (including 77A), and 211 to 213.

Lithological Characters.—Nos. 58 to 63, 64A, and 211 to 213, are dark, umber-coloured mudstones, practically devoid of calcareous matter, with occasional traces of fossils (casts). These rocks are more or less regularly bedded, and, in certain cases, tend to become conglomeratic. The general structure points to their having been formed under shallow water conditions.

Nos. 64, 66 to 77, and 77A are fossiliferous limestones, varying from brownish-grey to dark-grey, and weathering to a bright brick-red colour. They are rich in crinoid and coral remains, and the particular bed from which they were taken promises eventually to prove a veritable storehouse of Silurian fossils.

Some of these limestones are compact and finely tinted, and, although they have been frequently cracked, the fracture-lines have been completely filled in with veins of pink calcite. These rocks present a striking appearance, being full of the joints of encrinites and massive corals, and would make handsome ornamental marbles when polished, comparing favorably with the "entrochial" marbles of Derbyshire, and the "madrepore" marbles of Devonshire.

Fossil Determinations.

Specimen Number.	Fossils, with remarks thereon.
211, 212 ...	(?) Brachiopods, obscure traces.
58 ...	Crinoid columnar (cast), and (?) *Orthis*.
59 ...	(?) *Atrypa;* (?) *Orthis*. Imperfect casts and moulds.
60 ...	A decorticated brachiopod valve, indeterminate.
61 ...	No traces of fossils externally. In thin section the rock is seen to be a volcanic tuff, more or less basic in character, with minute chips of quartz and some chlorite. Traces of ostracoda, and one complete carapace. (Slide No. 1079).
62, 63 ...	Cast of a simple rugose coral, indeterminate, but resembling *Petraia;* also in microscope section fragments of shells, embedded in a volcanic tuff containing much biotite and chlorite. (Slide No. 1080).
64 ...	Largely composed of the remains of at least two species of crinoids. Also impressions of brachiopod valves, probably referable to *Atrypa*.
64A ...	Fragment of a flattened orthoceracone, with a fairly large and eccentric siphuncle. Cast of (?) *Athyris*.
66 ...	*Cannapora australis*, sp. nov. See description at end of this report.
67 ...	Microscope slide No. 1011 shows this rock specimen to contain a branch of a ramose monticuliporoid (indeterminate); pellets of *Girvanella*, cf. *incrustans*, Wethered (non Bornemann), and of G. (?) *pisolitica*, Weth. showing the primary series of cells; numerous ossicles of crinoids with the echinodermal structure preserved; fragments of brachiopod shells; sections of the carapaces of trilobites and ostracoda; embedded in a crystalline calcitic base.
68 ...	Microscope slide No. 1012 contains several fragments of corals, including *Favosites* sp. and *Monotrypa* sp. (see Pl. IV., fig. 8); also fragments of brachiopod shells and carapaces of ostracoda. The larger portion of the rock consists of the remains of crinoids, including part of a column and arm-ossicles.
69 ...	*Cannapora australis*, sp. nov.
70, 71 ...	Remains of crinoids.
72 ...	*Cannapora australis*, sp. nov. (Pl. VIII., fig. 18). Also *Heliolites* sp., at base of above coral.

Specimen Number.	Fossils, with remarks thereon.
73 ...	Rock specimen No. 73 shows superficially numerous crinoid joints, and a portion of a corallum of *Favosites gothlandica*, Lam. (variety with small corallites). The microscope slide 1013 shows the presence of the following organisms:— *Favosities gothlandica*, Lam. (var. with corallites having a usual diameter of 1 mm., and showing the two vertical series of mural pores); monticuliporoids (fragments); crinoid remains (very abundant); sections of minute acicular spines of (?) *Palæechinus* sp. (several, see remarks at end of report); polyzoa (fragments); trilobites (sections of the carapace numerous); ostracoda frequent, including *Primitia* spp., *Bythocypris* cf. *caudalis*, Jones, and *Bythocypris hollii*, Jones (see Pl. IV., fig. 9).
74 ...	The fractured rock appears to be full of crinoid remains, the cleavage surfaces of the joints imparting a crystalline character to the mass. A microscope-slide reveals the following organic remains:—*Girvanella conferta*, sp. nov., one pellet 3 mm. in length (Pl. VI., figs. 13, 14); (?) *Palæechinus* sp. (spines); *Rhombopora gippslandica*, sp. nov. (Pl. II., fig. 4; Pl. VII., fig. 15); trilobites (fragments of carapace); ostracoda, apparently referable to *Primitia* spp.
75 ...	*Favosites gothlandica*, Lam. The mode of preservation of this fossil is rather peculiar, since the walls of the corallites are practically recrystallized and fused with the infiltrated calcite, so that only the "dark line" of the original coral for the greater part of this corallum remains differentiated, and the corallites appear to have excessively thin walls (Pl. II., fig. 5). Also numerous crinoid remains in the débris surrounding the coral.
76, 77 ...	Rock composed chiefly of crinoid remains.
77A ...	*Favosites gothlandica*, Lam.; and numerous crinoid remains. The friable weathered surface of this specimen yielded several small fossils on scrubbing the rock, viz., acerate and flattened spines of a palæechinoid, grooved arm-ossicles of crinoids, and a small ostracod, nearly related to *Primitia paucipunctata*, Jones and Hall, a species which has been previously recorded by the writer from the Yeringian limestone of Cave Hill, Lilydale.[1]

---

[1] Proc. Roy. Soc. Vict., Vol. xvii., n.s., pt. 1, 1904, p. 305; Pl. xiv., figs. 4*a*—*c*; Pl. XV., figs. 2*a*—*c*.

SPECIMENS FROM MARBLE CREEK. (NO. 42 ON LOCALITY MAP.)

The fossiliferous rocks from Marble Creek are numbered 78-99.

Lithological Characters.—Nos. 78 to 95 are pale grey to dark blue limestones, chiefly composed of the remains of crinoids, but occasionally containing fossils of a very interesting nature. This limestone appears to be generally compact, and, as it takes an excellent polish, would form a valuable marble for ornamental purposes.

Nos. 96 to 99 are more or less of the nature of ferruginous shell-grits and conglomerates, with included fragments of pebbles of shale and ovoid pellets of igneous origin.

Mr. Kitson reports that the fossiliferous conglomerate beds at Marble Creek overlie the crinoidal limestones.

FOSSIL DETERMINATIONS.

Specimen Number.	Fossils, with remarks thereon.
78 ...	This limestone is almost entirely composed of the stems and ossicles of crinoids. In thin slices a spine of (?) *Palæechinus*, ostracoda, polyzoa (fenestellids) and a fragment of a fistuliporid, were observed. The organic fragments are compactly cemented by finely crystalline calcite, containing some opaque, granular impurities, probably of the nature of iron and copper pyrites.
79-82 ...	Crinoid remains.
83 ...	Crinoid remains and *Niso* (*Vetotuba*) *brazieri*, Etheridge fil.
84 ...	Crinoidal limestone. In thin sections, crinoid plates and polyzoa.
85, 86 ...	Crinoid remains.
87 ...	Crinoid remains abundant. *Trochus* (*Scalætrochus*) sp. (a fragment). *Phacops* sp. (impression of cephalon and several thoracic segments).
88-91 ...	Crinoid remains.
92, 93 ...	Crinoid remains, and a small massive (?) coral with badly preserved structure, probably a monticuliporoid.
94, 95 ...	Crinoid remains.
96 ...	Fossiliferous conglomerate, with casts of brachiopods and columnars of crinoids.
97 ...	Ferruginous conglomerate, with doubtful brachiopod remains.
98 ...	Ferruginous conglomerate, with crinoid and brachiopod remains.
99 ...	Ferruginous conglomerate with crinoid remains.

DESCRIPTION OF NEW OR LITTLE-KNOWN FORMS.

Class ALGÆ.

Genus GIRVANELLA, Nicholson and Etheridge fil. Pl. I., fig. 2; Pl. V., figs. 10-12; Pl. VI., figs. 13, 14.

This genus was instituted by Prof. H. A. Nicholson and Mr. R. Etheridge, junr., in 1880[1], to include certain minute tubular organisms, forming pellets from less than a millimetre to more than a centimetre in diameter, which occur rather plentifully in the Ordovician limestone of Craighead, Girvan, Scotland. *Girvanella* was supposed by the authors of the genus to belong to the Foraminifera, and related to *Hyperammina*, and this view was endorsed by Dr. H. B. Brady and other authors. In the opinion of the present writer, the evidence for their rhizopodal relationship is very slender, whilst there is a great deal in favour of the view already advocated by Rothpletz, Seward, and others that they are referable to the Algæ. They may either belong to the group of the Blue-Green Algæ, *Cyanophyceæ*, which form the oolitic granules in the Great Salt Lake of Utah at the present day,[2] or to the *Siphoneæ*, to which group Rothpletz referred his *Sphærocodium*, which apparently formed nodules similar to *Girvanella* in the Alpine Trias.

Since 1880, *Girvanella* has been recognised as an important agent in the formation of many oolitic limestones in England, ranging from the Silurian to the Jurassic.[3] Nicholson also identified with this genus similar nodular organisms in the Cincinnati limestone of Indiana.[4]

The only accounts of the occurrence of this genus in Australia hitherto published are those given by Messrs. R. Etheridge, junr., and G. W. Card[5], who record it from the Carboniferous Oolite of Lion Creek, Stanwell, near Rockhampton, Queensland, and from County Murchison, New South Wales; and by the former author, who described it from the Cambrian of South Australia.[6] It is, therefore, of additional interest to record *Girvanella* in Victoria as an abundant and important organic agent in the formation of limestones belonging to the Yeringian division of the Silurian. Previous to the discovery of *Girvanella* in the Gippsland area, the writer had met with it in the Lilydale limestone, which is also in the Yeringian series, his attention having been drawn to it by the Rev. A. W. Cresswell, M.A., who observed that certain portions of the limestone had a decidedly oolitic appearance.[7]

Girvanella conferta, sp. nov.

Plate VI., figs. 13, 14.

Description.—Filiform tubes having an almost uniform diameter of .017 mm.; closely packed, and arranged in groups in a vermiculate manner, either sinuously contorted or wound in more or less parallel bundles; segmented at intervals. Forming pellets, sometimes reaching a length of 3 mm. or more.

Observations.—This form differs from *G. problematica*, Nich. and Eth. fil.[8], in having the tubes in bundles lying side by side, and in being segmented at intervals by transverse or oblique partition walls, at which place the tube is generally constricted. In *G. problematica*, on the contrary, the tube appears to be of indefinite length, and contortedly coiled upon itself. The diameter of the tube in both species is about the same. In *G. problematica* the tube is loosely wound, whilst in the present species it is densely packed together. *G. conferta* also occurs in a slide of Wenlock limestone from Dudley, England, prepared by the writer several years ago.

---

[1] Mon. Sil. Fossils, Girvan District, vol. i., pp. 23, 24, Pl. ix., fig. 24.

[2] See Seward, A. C., Fossil Plants, vol. i., 1898, p. 124.

[3] See Wethered, E., Geol. Mag., Dec. iii., vol. vi,, 1889, pp. 196-200, pl. vi., figs. 8-11. Also papers by the same author in Quart. Journ. Geol. Soc., vols. xlvi.-xlix. (1890-1893).

[4] Geol. Mag., Dec. iii., vol. v., 1888, p. 24.

[5] Geol. Surv. Queensland, Bulletin No. 12, 1900, pp. 26, 27, 32.

[6] Trans. R. Soc. S. Australia, vol. xiii., 1890, pp. 19, 20.

[7] See also Proc. R. Soc. Vict., vol. v., n.s. 1893, p. 39.

[8] Mon. Sil. Foss., Girvan Dist., vol. i., 1880, p. 23, pl. ix., fig. 24.

Locality and Horizon.—Tyers River, Gippsland, and Cave Hill, Lilydale. Silurian (Yeringian). Also in the Silurian (Wenlockian) of Dudley, England.

Girvanella cf incrustans, Wethered (non Bornemann sp.)

Plate V., figs. 11, 12.

Girvanella incrustans, Wethered, 1890, Quart. Journ. Geol. Soc., Vol. XLVI., p. 280, Pl. XI., figs. 1*a*, *b*.

Observations.—Certain of the *Girvanella* pellets in the Tyers River limestone have very tortuous tubes, closely packed, the tubes measuring .014 mm. in diameter. This form closely approaches the above-named species described by Wethered from the Carboniferous Limestone of Clifton, England, both as to the size of the tubules and their habit of growth.

Locality and Horizon.—Tyers River, Gippsland. Silurian (Yeringian).

Girvanella (?) pisolitica, Wethered.

Plate V., fig. 10.

Girvanella pisolitica, Wethered, 1889, Geol. Mag., Dec. III., Vol. VI., p. 200, Pl. VI., fig. 10.

Observations.—A form of *Girvanella* also occurs rather frequently in the Tyers River Limestone, which resembles in some respects the above species described and figured by Mr. Wethered. It is an encrusting form, found adherent to organic fragments, such as joints of crinoids. The tubes are much larger in diameter than they are in the other forms of *Girvanella*, and the earlier part of the (?) thallus is composed of sphæroidal or ovoid segments, having a comparatively thick, translucent cell-wall, apparently non-calcified, and usually of a pale brown colour (Pl. IX., fig. 10). This segmented series is often seen to pass into the greatly extended tube typical of the *Girvanella* structure forming the bulk of the pellet, by more and more elongated cells. divided by transverse or oblique partitions. The several segments bear some resemblance to the "Schlauche mit Sporangien" in Rothpletz's *Sphærocodium*[1]; and Wethered also figures a nodule of *Girvanella* (*G. pisolitica*)[2] from the Inferior Oolite of Cheltenham, England, which shows a linear series of small sub-spherical segments, such as are found in the Gippsland forms. The diameter of the spherical or pyriform segments in our specimens averages .07 mm.

Locality and Horizon.—Tyers River, Gippsland. Silurian (Yeringian).

---

[1] Zeitschrift Deutsch. Geol. Gesellsch., vol. xliii., 1891, pl. xvi., figs. 4, 5.
[2] *Loc. supra cit.*, fig. 10.

Class ANTHOZOA.

Genus CANNAPORA, J. Hall.

Cannapora australis, sp. nov.

Plate III., figs. 6, 7; Pl. VIII., figs. 17, 18.

Specific Characters.—Corallum of large size, forming tabulate, reef-like masses. Corallites at first horizontal, repent, subsequently giving off closely arranged vertical corallites. The vertical corallites are circular or sub-circular when free, with dilated orifices, to polygonal (generally hexagonal) when in contiguity with the neighbouring corallites. Horizontally expanded corallites form distinct layers or platforms at more or less regular intervals of about 3 to 5 mm., and from this layer emanates a dense vertical growth of tubular coralites. Diameter of the latter varies from .35 to .7 mm. Septa short, spiniform, numerous (number not definitely ascertainable owing to indifferent preservation in this respect, but apparently about 12.) Tabulæ abundant, very irregular; straight, curved or oblique, usually convex; about three tabulæ in the space of 1 mm. Lateral connecting tubes large, often occupying half the length of the wall between the tabulæ.

Observations.—The above coral in many respects resembles the well-known species *C. junciformis*, Hall.[1] It differs, however, in having more numerous and irregular tabulæ in the vertical corallites; and in its strong tendency to form instead of one platform of prostrate tubules, successive series, forming in more or less regular layers, which apparently take the place of the horizontal expansions of the walls, described in the American species. This mode of growth produces a thick and widely expanded corallum.

It is of great interest to find this genus in the Yeringian limestones of Gippsland, since it was hitherto only known in the Clinton and Niagara Groups of the United States, and, in the latter series, in Canada.

Locality and Horizon.—Tyers River, Gippsland. Silurian (Yeringian).

Genus FISTULIPORA, McCOY.

Fistulipora sp.

Plate II., fig. 3.

An example of an encrusting, lamellate *Fistulipora* occurs in slide 207; structure somewhat obscured by mineralization. In one part of the coral the section passes transversely through the autopores, showing them to be characteristically sub-circular or pyriform. They measure about 3 mm. in diameter, and are surrounded by the radially-grouped, interstitial tubes. On comparing this example with the type of the genus, *F. minor*, McCoy[2], to which it bears a certain resemblance, it is seen that the autopores are only slightly smaller than those in the Carboniferous fossil. Ulrich describes and figures a species, *F. communis*, which agrees in general structural characters with our specimen, from the Hamilton Group (Devonian) of Illinois[3]. This species, which Ulrich subsequently termed *Cyclotrypa communis*, has circular autopores, and in this respect seems to differ from ours. Further material, however, is required before a closer comparison can be made. The present example shows an extent of 23 mm.

---

[1] Hall, Palæont. N. York, vol. ii., 1852, p. 43, pl. xviii., figs. 1*a*-1*f*.
See also Rominger, Geol. Surv. Mich., Foss. Corals, 1876, p. 85, pl. xxxiii., fig. 4; and Lambe, Contrib. Canad. Palæont, vol. iv., pt. 1, 1899, Canad. Pal. Corals, p. 63.

[2] See Nicholson, "On the Structure and Affinities of the genus Monticulipora and its Sub-genera," 1881, p. 92, fig. 16.

[3] Geol. Surv. Illinois, vol. VIII., 1890, p. 476, pl. XLVII., figs. 1, 1*a*; pl. XLVIII., figs. 1, 1*a*.

or more in one direction. The genus, as an Australian fossil, has been previously recorded, with some observations, by R. Etheridge, jun.[1], from the Carboniferous oolitic limestones of Stanwell, Queensland.

Locality and Horizon.—Thomson River, Gippsland. Silurian (Yeringian).

Genus MONTICULIPORA, D'Orbigny.

Sub-Genus MONOTRYPA, Nicholson.

Monotrypa sp. Plate IV.; fig. 8.

Observations.—An example of this sub-genus has already been found in a Victorian limestone by Mr. W. S. Dun[2], the locality, near Mansfield, being in all probability on the same horizon as the present series from Tyers River. So far as the present example goes, we have only an approximately transverse section of the fossil, so that further than stating that it agrees in that respect with Mr. Dun's fossil, we cannot venture. In our specimen, where the corallites are cut through somewhat obliquely, traces of thin, distant diaphragms are seen.

Locality and Horizon.—Tyers River, Gippsland. Silurian (Yeringian).

Class ECHINOIDEA.

Genus (?) PALÆECHINUS (Scouler), McCoy.

Spines of a palæechinoid, probably referable to *Palæechinus.* Plate IV,. fig. 9; pl. VII., fig. 16.

The spines here provisionally referred to *Palæechinus* are somewhat abundant in the Tyers River limestone. Those shown in the accompanying photographs are sections which pass through the spines both transversely and longitudinally. The spines are a little variable in size; they are acicular and of medium length, and generally resemble those which have been figured as occurring with the test of *Palæechinus.* In the diagnosis of this genus Duncan[3] says, "spines small, acicular, short." The peculiar structure seen in the longitudinal section (Pl. XI., fig. 16) is brought out in places by an infiltration of dark limonitic material into the more cellular areas of the spine. This gives a somewhat analogous appearance to that observed by the writer in certain echinoid spines resembling *Hemipedina*, found in Lower Cretaceous limestones in the South of England, in which the spines had been invaded by glauconite[4]. The transverse sections of some of the spines seen in the thin slices of the Tyers River limestone have a fimbriated periphery, which indicates that the spine was finely and closely grooved down its length. A similar spine is figured by W. H. Bailey[5], as occurring with *Palæechinus elegans*, McCoy[6], and the length there given coincides exactly with ours.

The first account of the occurrence of the genus *Palæechinus* in Australia was given by Mr. J. Mitchell[7], who described an imperfect test from the Middle Trilobite bed (Silurian) of Bowning, New South Wales.

In the Melbourne National Museum collection there is a single interambulacral plate of *Palæechinus*, which was generically determined by McCoy. This specimen differs in its ornamentation from the plates figured by Mitchell, in having a finer tuberculated surface (so far as can be seen from our specimen, which is somewhat weathered), and is twice as long and broad as the plates in the Bowning specimen. The Victorian example came from the Silurian of Fraser's or No. 3 Creek, Springfield, Geol. Surv. coll., Bb 25.

---

[1] Geol. Surv. Queensland, Bull. No. 12, 1900 p. 8.

[2] Proc. R. Soc. Vict., vol. X., n. s., 1898, pt. II., p 89.

[3] Journ. Linn. Soc. Lond., Zool., vol. XXIII., 1891, p. 14.

[4] Quart. Journ. Geol. Soc., vol. L., 1894, p. 680.

[5] Journ. R. Geol. Soc. Ireland, vol. I., 1867 (1864–7), pl. IV., fig. E.

[6] This species is now referred to the genus *Rhœchinus*, Keeping, which has only one row of pairs of pores on each side of an ambulacrum. The genus is essentially Carboniferous, as known at present.

[7] Proc. Linn. Soc. N.S.W., vol. XXII., pt. 2., 1897, p. 258.

Locality and Horizon.—Tyers River, Gippsland. Silurian (Yeringian).

Class POLYZOA.

Sub-Order *Cryptostomata.*

Genus RHOMBOPORA, Meek.

Rhombopora gippslandica, sp. nov.

Plate II., fig. 4; pl. VII., fig. 15.

Description.—Zoarium slender, branching; the branches cylindrical to subangulate. Diameter of branches 1 to 2 mm. Apertures arranged in vertical series, the rows variable in number, from 6 to 10; ovate, deeply excavate, and abrupt on lower edge, which generally carries a spine. Length of aperture .5 mm.; width .3 mm. Space between rows of apertures occupied by a more or less elevated granulose ridge. Axial tube apparently present, thin and flexuous. Zoœcial tubes at first slightly divergent, and then curving outward to the external surface. Hemisepta present, situated near the zoœcial openings.

Observations. — The above diagnosis is derived from casts in mudstone occurring abundantly in the Silurian of Wombat Creek, Mitta Mitta River, and from several sections seen in the thin slices of limestone from Tyers River.

In certain points the above species closely resembles *Rhombopora ovatipora*, J. Hall sp.[1], from the Lower Helderberg of New York State. The branches of *R. gippslandica*, however, are more than twice the diameter of Hall's species, and, whilst the latter has a fairly constant character in the five or six vertical rows of apertures, *R. gippslandica* exhibits in the basal portions of the zoarium as many as ten. In *R. rhombifera*, Hall sp.[2] may be seen the character of variation in the diameter of the branches, but the apertures are not separated by the vertical ridges.

The genus *Rhombopora* has apparently been hitherto recorded from Australia only from Carboniferous beds by Dr. G. J. Hinde, who described *R. tenuis*, from the Gascoyne River, Western Australia.[3]

Locality and Horizon.—Tyers River, Gippsland. Also in mudstone, Wombat Creek. Silurian (Yeringian).

LIST OF FOSSILS MENTIONED IN THIS REPORT.

Thomson River.

Name.	Number of Specimen.
Girvanella	205, 65.
(?) *Alveolites*	205
Fistulipora, sp, indet.	207.
Stromatoporoid, indet., ...	205.
Crinoid remains, indet.	204-210.
(?) *Primitia*	207, 65

---

[1] *Trematopora (Orthopora) ovatipora*, J. Hall, Pal. N. York, vol. VI., 1887, p. 17, pl. XI. figs. 9-11; pl. XXIII., fig. 5.

[2] *Trematopora (Orthopora) rhombifera*, J. Hall, ibid., p. XVIII, pl. XI., figs. 15. 17-20; pl. XXIII., figs. 11, 12.

[3] Geol. Mag. Dec. III., vol. VII., p. 203, pl. VIIIA., figs. 4, 4*a*.

Tyers River.

Name.	Number of Specimen.
Girvanella conferta, sp. nov. ...	74.
G. (?) *pisolitica*, Wethered. ...	67.
G. cf. *incrustans*, Wethered. ...	67.
(?) *Petraia*	62, 63.
Favosities gothlandica, Lam. ...	73, 75; 77A.
F. sp. indet.	68.
Cannapora australis, sp. nov. ..	66, 69, 72.
Monticuliporoids, indet.	73.
Monotrypa sp.	68.
Heliolites sp.	72.
Crinoid remains, indet.	58, 64, 67, 70, 71, 73-77, 77A
(?)*Palæechinus*, spines of	73, 74, 77A.
Polyzoa	73.
Rhombopora gippslandica, sp. nov. ...	74.
Brachiopods, indet.	211, 212, 60, 68.
(?) *Orthis*	58, 59.
(?) *Athyris*	64A.
(?) *Atrypa*	59, 64.
(?) *Orthoceras*	64A.
Trilobite remains, indet.	67, 73, 74.
Ostracoda, indet.	61, 67, 68.
Primitia sp.	73, (?) 74.
Primitia, aff. *paucipunctata* J. and H.	77A.
Bythocypris, cf. *caudalis*, Jones. ...	73.
B. hollii, Jones	73.

Marble Creek.

Name.	Number of Specimen.
(?) Monticulidoroid	78, 92, 93.
Crinoid remains, indet.	78, 96, 98, 99.
Spine of (?) *Palæechinus*	78.
Polyzoa, indet.	78, 84.
Brachiopoda, indet.	96-98.
Trochus (*Scalætrochus*) sp.... ...	87.
Niso (*Vetotuba*) *Brazieri*, Eth. fil. ...	83.
Phacops sp.	87.
Ostracoda indet.	78.

EXPLANATION OF PLATES.

Plate I.

Fig. 1. Crinoidal limestone, Thomson River, No. 208. × 15.

Fig. 2. Sheared limestone, Thomson River; showing crinoid joints, Ostracoda, *Girvanella* and biotite flakes, No. 65. × 15.

Plate II.

Fig. 3. *Fistulipora* sp., Thomson River. Vertical section in limestone. No. 207. × 15.

Fig. 4. *Rhombopora gippslandica*, sp. nov. Vertical section in limestone. Tyers River, Gippsland. No. 74. × 15.

Fig. 5. *Favosites gothlandica*, Lam. Vertical section of corallites, showing secondary recrystallization of walls. Tyers River. No. 75. × 15.

Plate III.

Fig. 6. *Cannapora australis*, sp. nov. Transverse section. Tyers River. No. 66. × 15.

Fig. 7. *Cannapora australis*, sp. nov. Nearly vertical, but slightly oblique, section. Tyers River, No. 66. × 15.

Plate IV.

Fig. 8. *Monotrypa* sp. Transverse section. Tyers River. No. 68. × 35.

Fig. 9. Section of limestone showing carapace of *Bythocypris hollii*, Jones, and transverse section of spine of (?) *Palæechinus*. Tyers River. No. 73. × 35.

PLATE V.

Fig. 10. Section of limestone showing initial stages of *Girvanella* (?) *pisolitica*, Wethered, (near centre of photograph), and crinoid ossicles. Tyers River. No. 67. × 35.

Fig. 11. *Girvanella* cf. *incrustans*, Wethered, forming a small pellet, in crinoidal limestone. Tyers River. No. 67. × 35.

Fig. 12. *G.* cf. *incrustans*, Wethered. A portion of the same, more highly magnified. No. 67. × 175.

PLATE VI.

Fig. 13. A larger pellet of *Girvanella conferta*, sp. nov., in crinoidal limestone. Tyers River. No. 74. × 35.

Fig. 14. A portion of the same, more highly magnified, showing the densely packed tubules. × 175.

PLATE VII.

Fig. 15. *Rhombopora gippslandica*, sp. nov. A transverse section. Tyers River. No. 74. × 35.

Fig. 16. Crinoidal limestone; showing ossicles, shell fragments, and a vertical section of spine of (?) *Palæechinus*. Tyers River. No. 74. × 35.

PLATE VIII.

Fig. 17. *Cannapora australis*, sp. nov. Vertical section of corallum, showing the numerous and irregular tabulæ. Tyers River. No. 66. × 15.

Fig. 18. *Cannapora australis*, sp. nov. Weathered surface of corallum, showing the platforms between the successional layers. Tyers River. No. 72. Natural size.

By Authority: J. Kemp, Acting Government Printer, Melbourne.

BRITISH MUSEUM NATURAL HISTORY

PRESENTED
15 JUL. 1907

PLATE I.

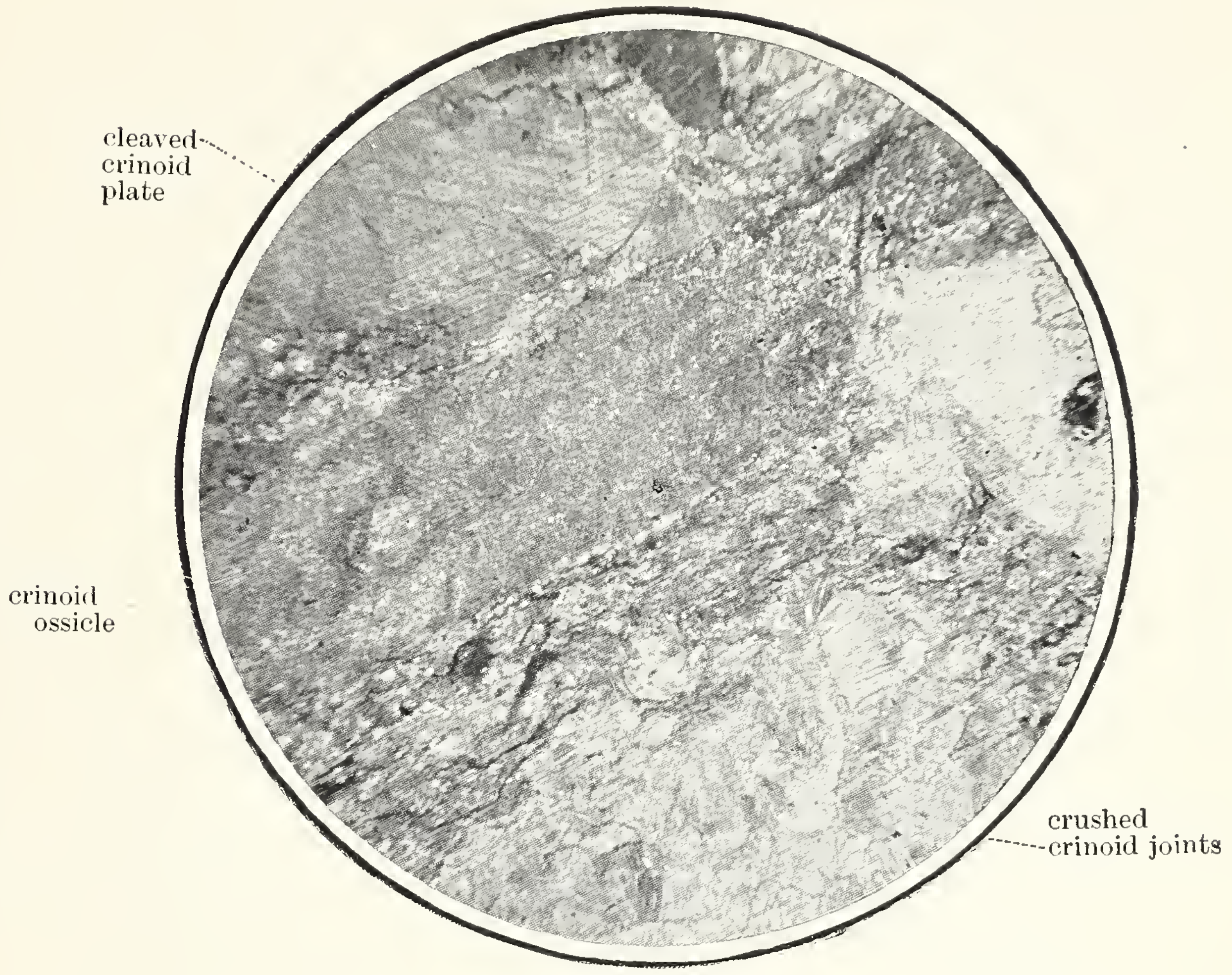


FIG. 1. × 15

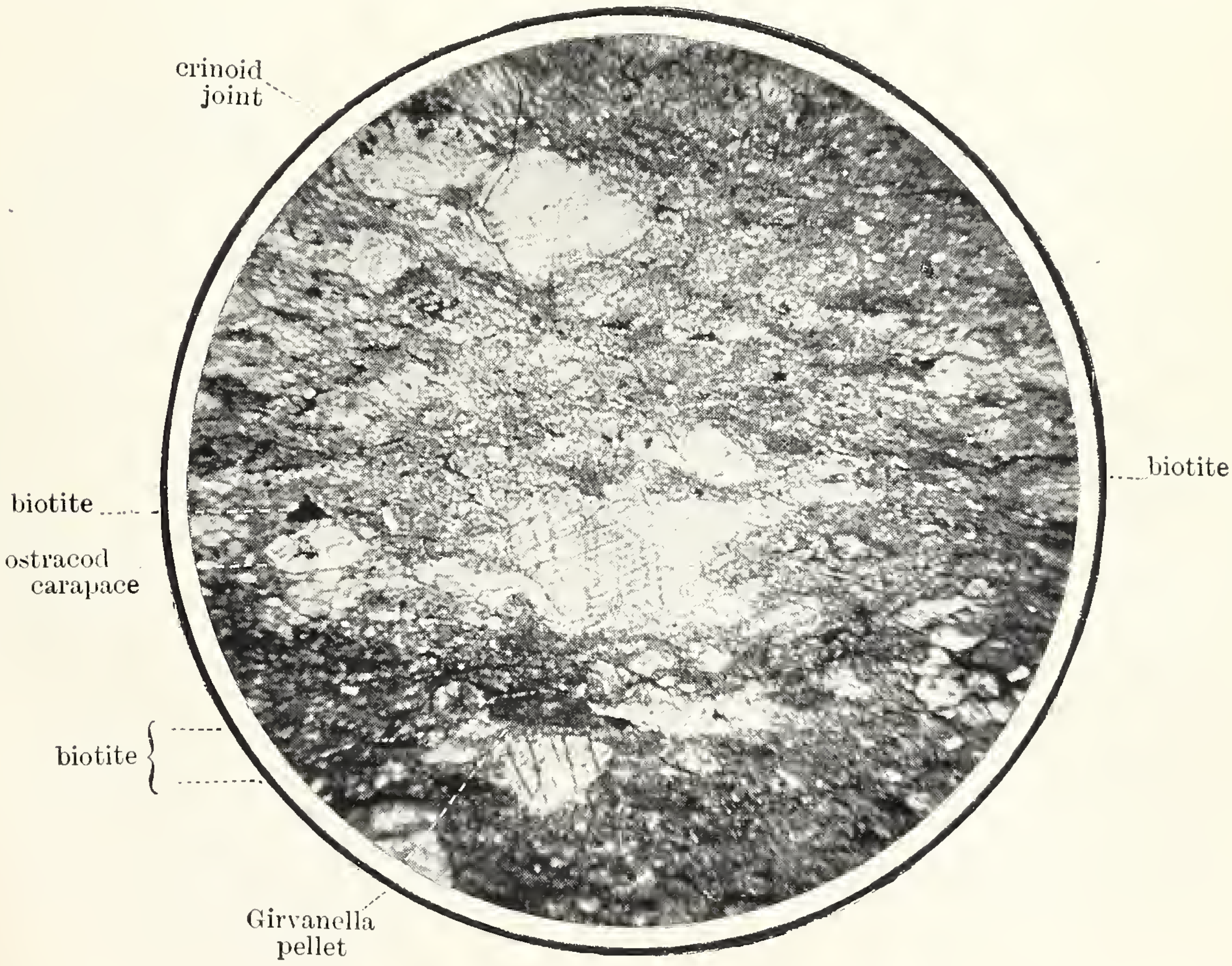


FIG. 2. × 15

F.C., photomier.

FOSSILIFEROUS LIMESTONE: THOMSON RIVER.

11120.

BRITISH MUSEUM
NATURAL HISTORY

PLATE II.

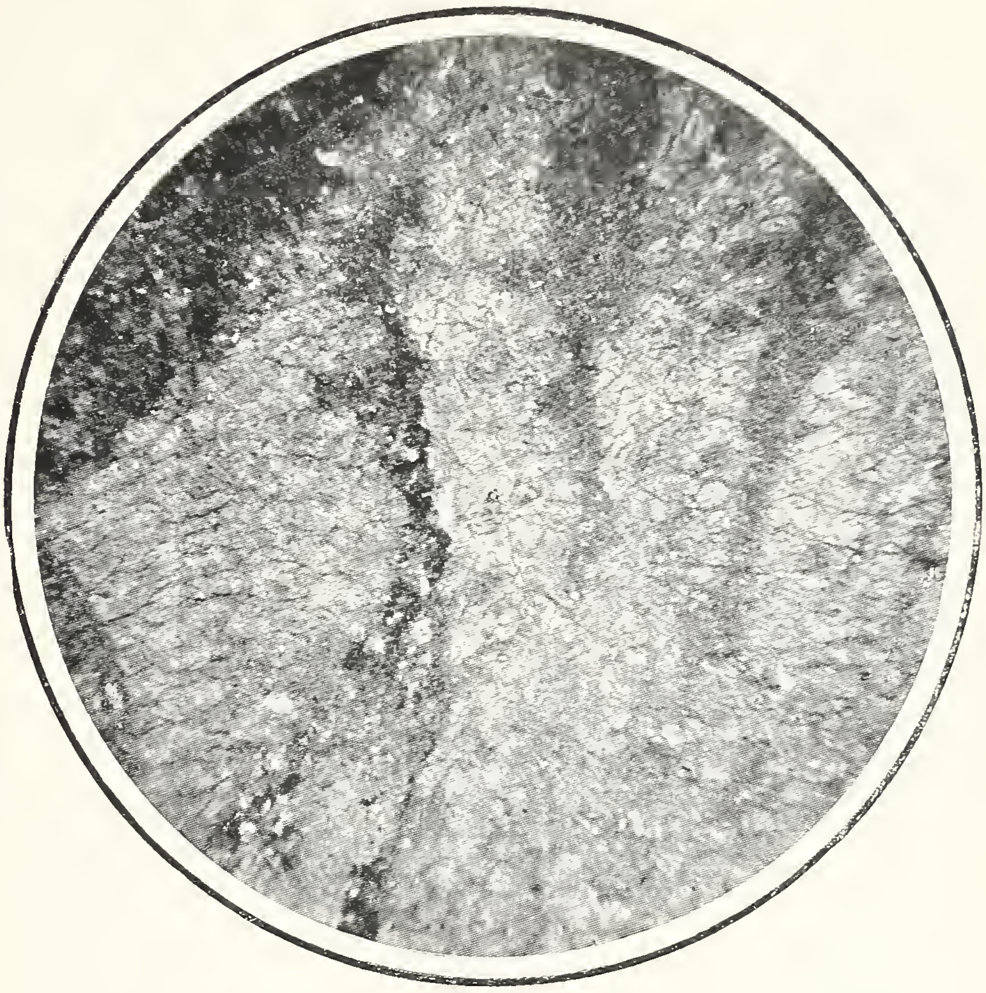


FIG. 3. × 15

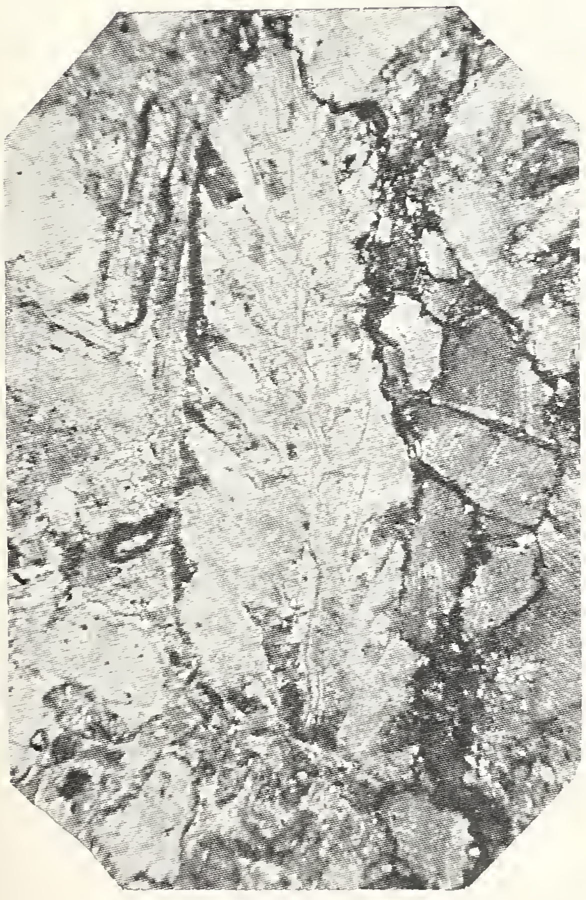


FIG. 4. × 15

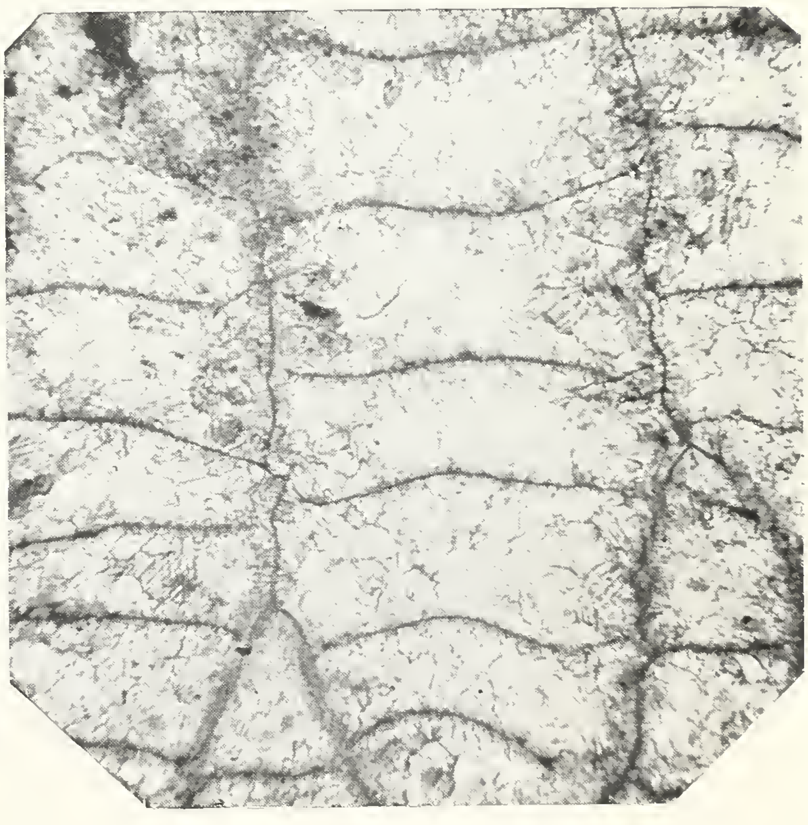


FIG. 5 × 15

F.C., photomier.

SILURIAN FOSSILS: THOMSON AND TYERS RIVERS.

BRITISH MUSEUM NATURAL HISTORY

PLATE III.

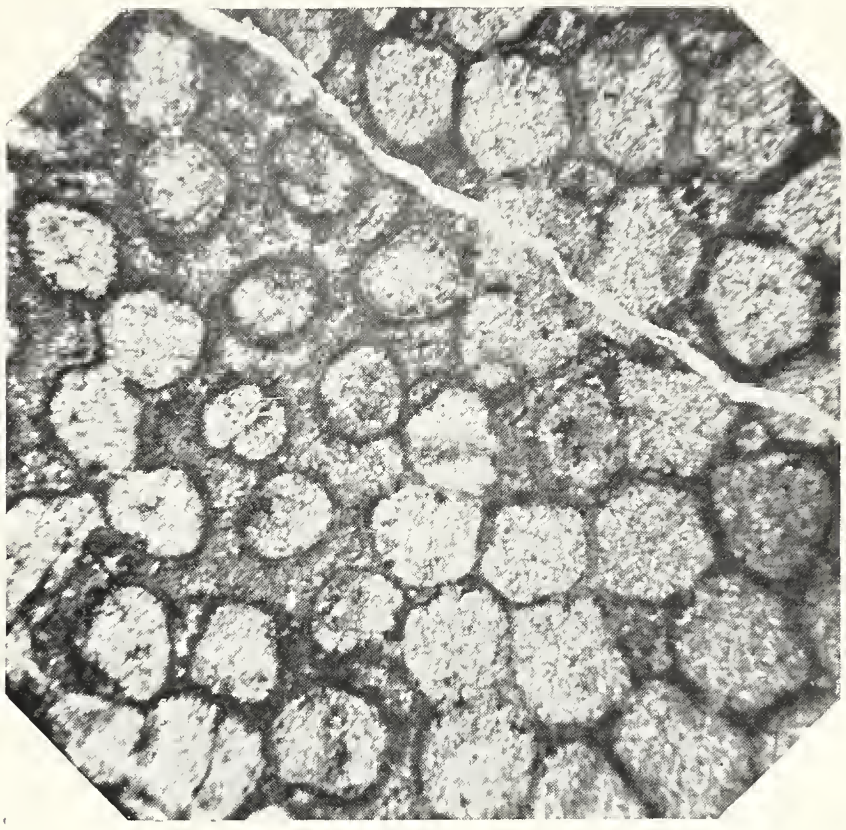


FIG. 6. × 15

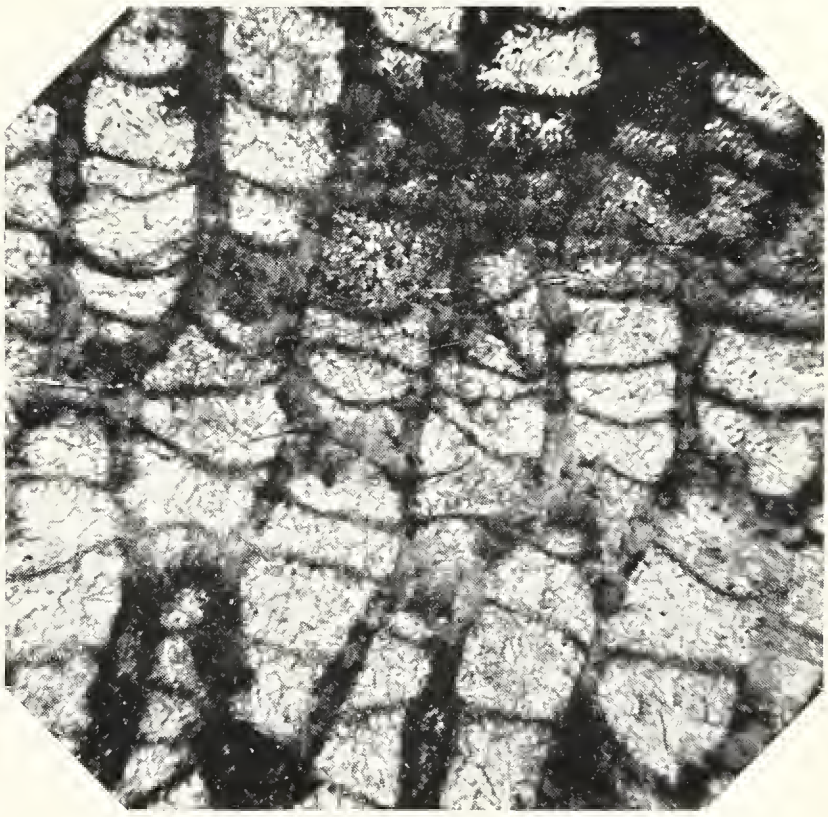


FIG. 7. × 15

F.C., photomier.

CANNAPORA AUSTRALIS SP. NOV.: TYERS RIVER.

BRITISH MUSEUM
D.
NATURAL HISTORY

PLATE IV.

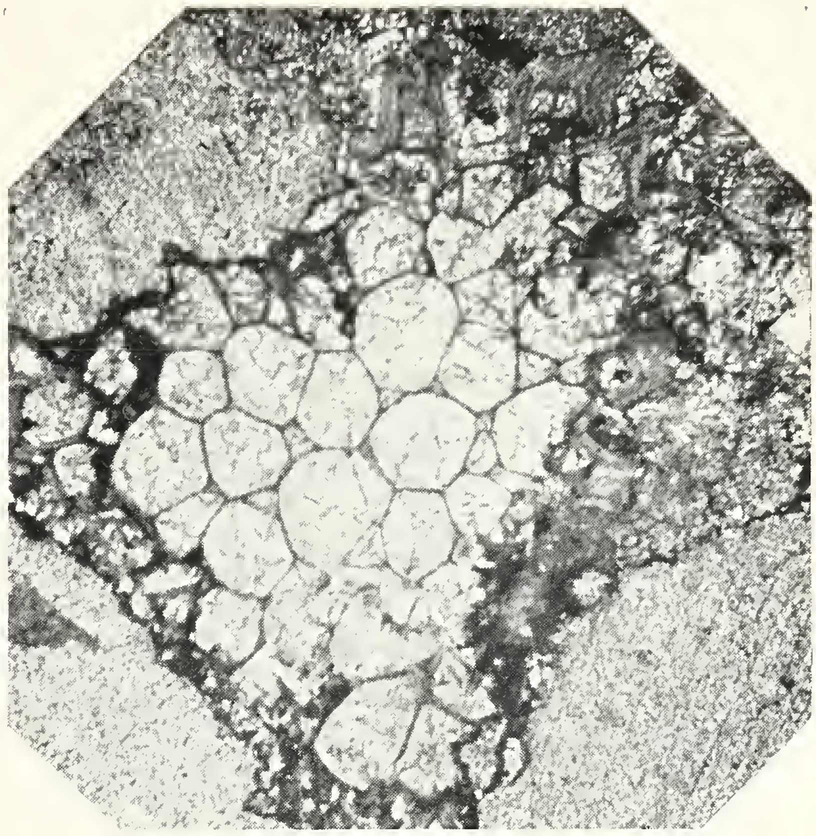


FIG. 8. × 35

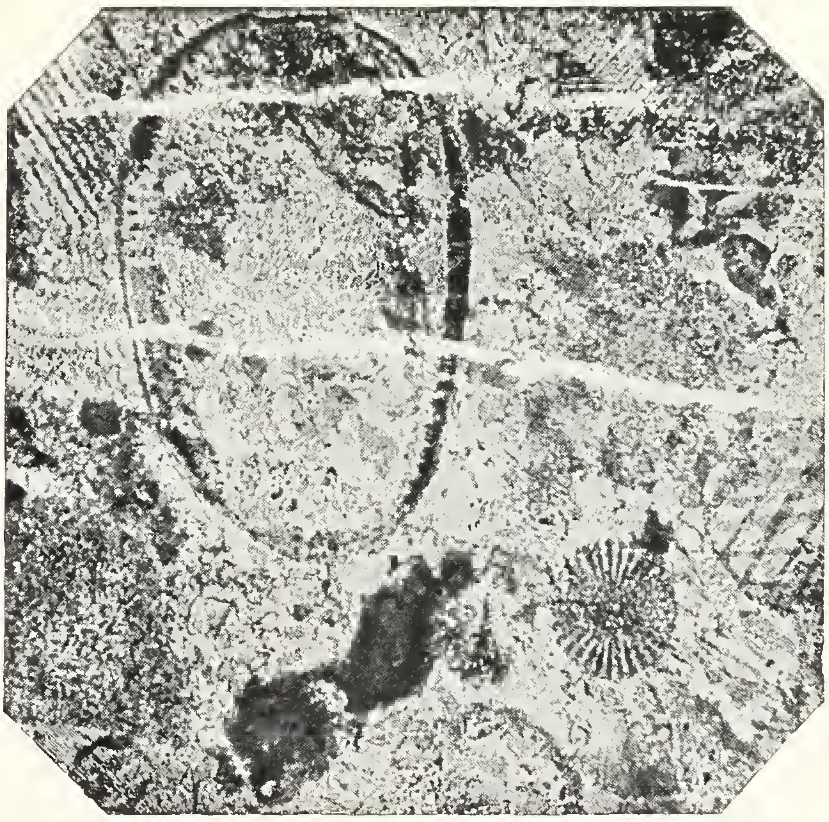


FIG. 9. × 35

F C., photomier.

SILURIAN FOSSILS: TYERS RIVER, GIPPSLAND.

BRITISH MUSEUM
G. D.
NATURAL HISTORY

PLATE V.

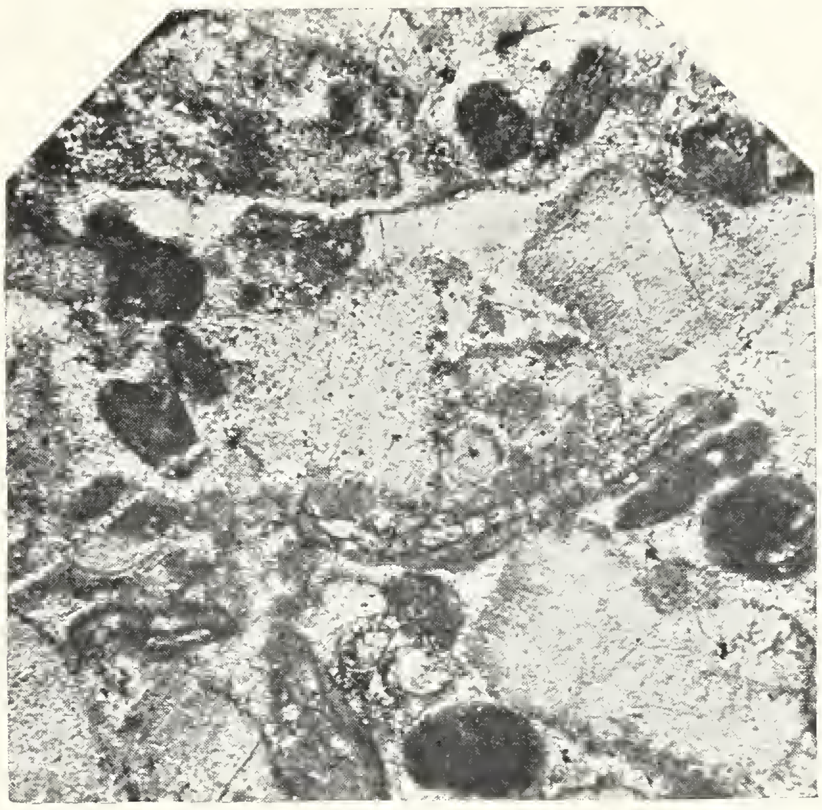


FIG. 10. × 35

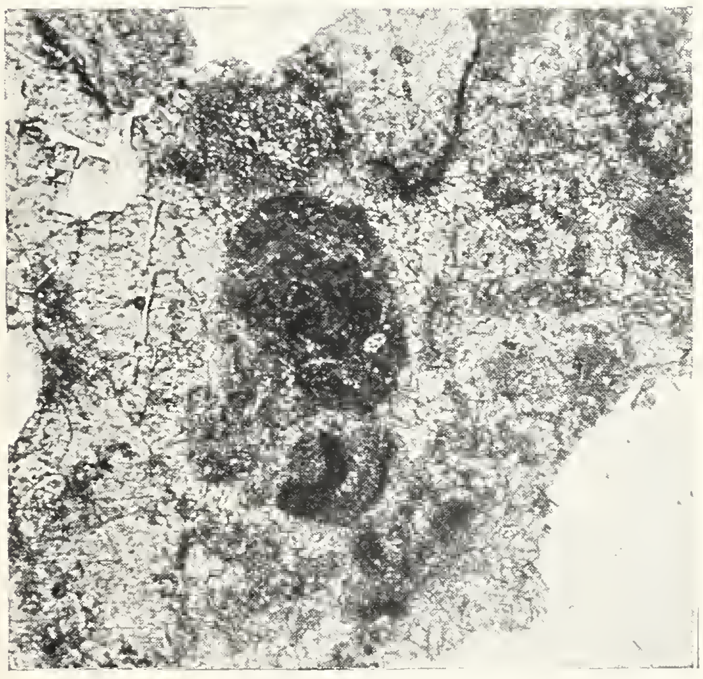


FIG. 11. × 35

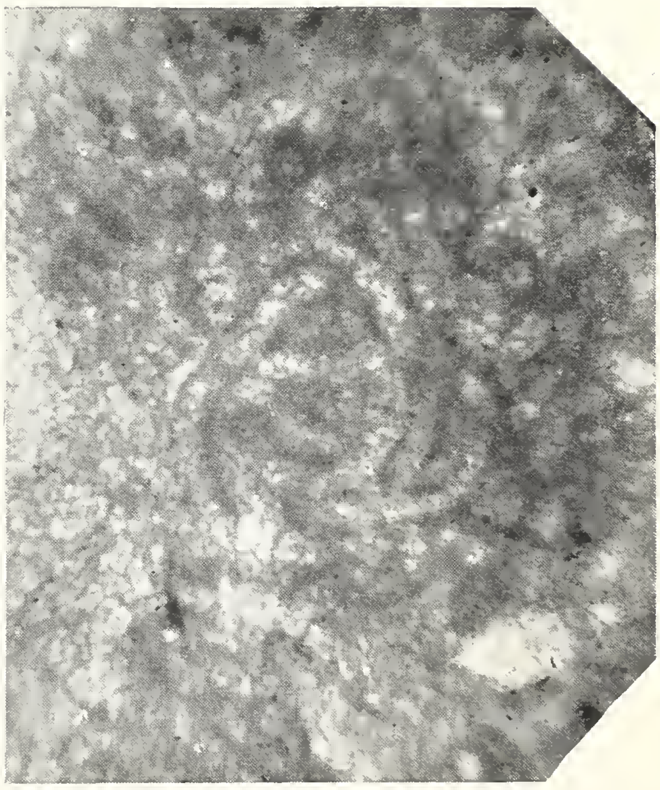


FIG. 12. × 175

F.C., photomier.

GIRVANELLA: TYERS RIVER, GIPPSLAND.

BRITISH MUSEUM
NATURAL HISTORY

PLATE VI.

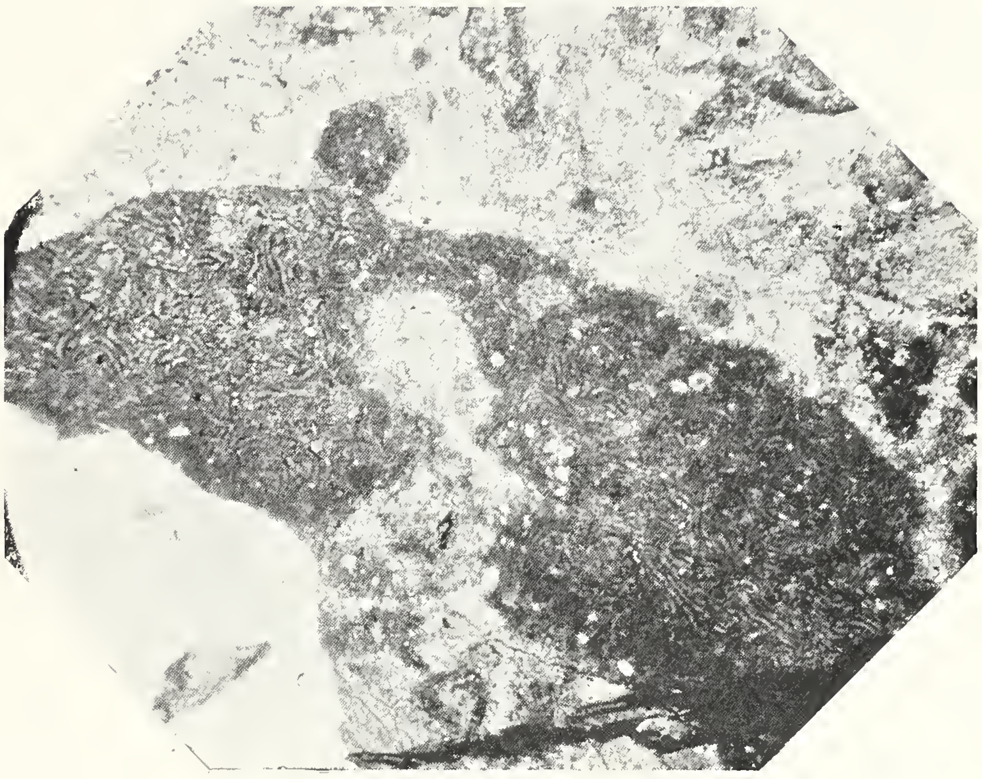


FIG. 13. × 35

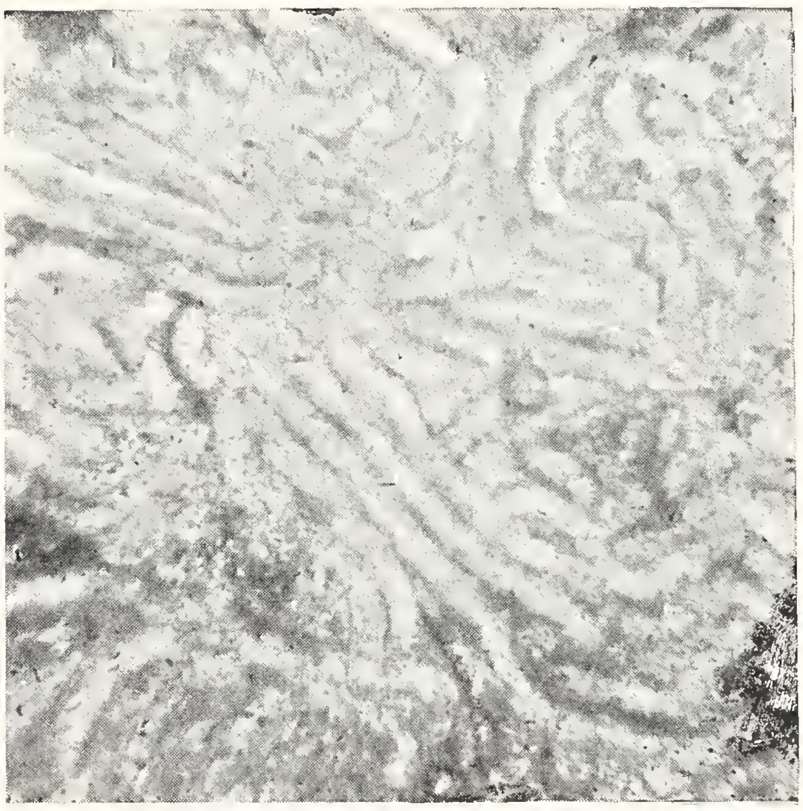


FIG. 14. × 175

F.C., photomier.

GIRVANELLA CONFERTA SP. NOV. : TYERS RIVER.

BRITISH MUSEUM
G D.
NATURAL HISTORY

PLATE VII.

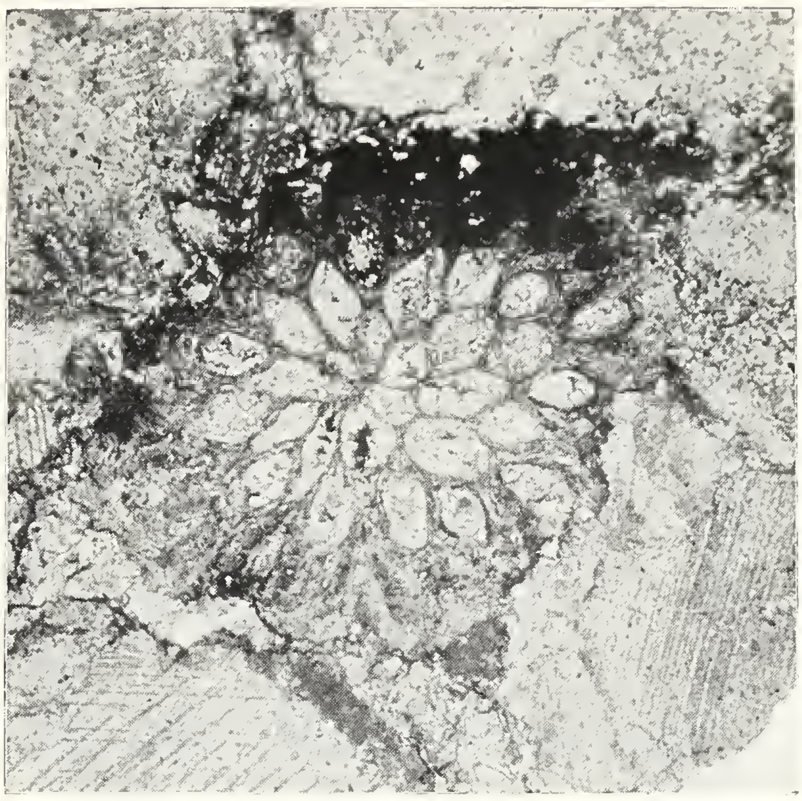


FIG. 15. × 35

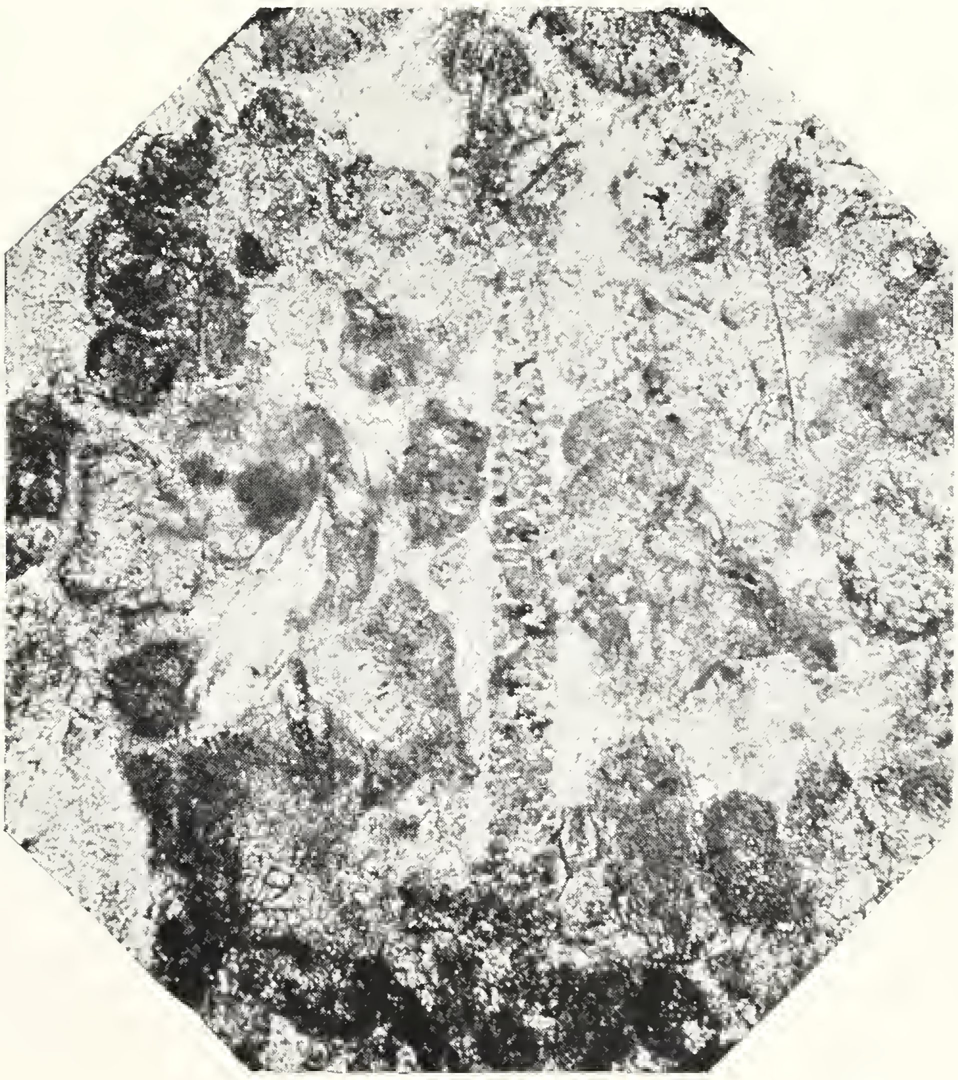


FIG. 16. × 35

F.C., photomier.

SILURIAN FOSSILS: TYERS RIVER, GIPPSLAND.

B. BRITISH MUSEUM D.
NATURAL HISTORY

PLATE VIII.

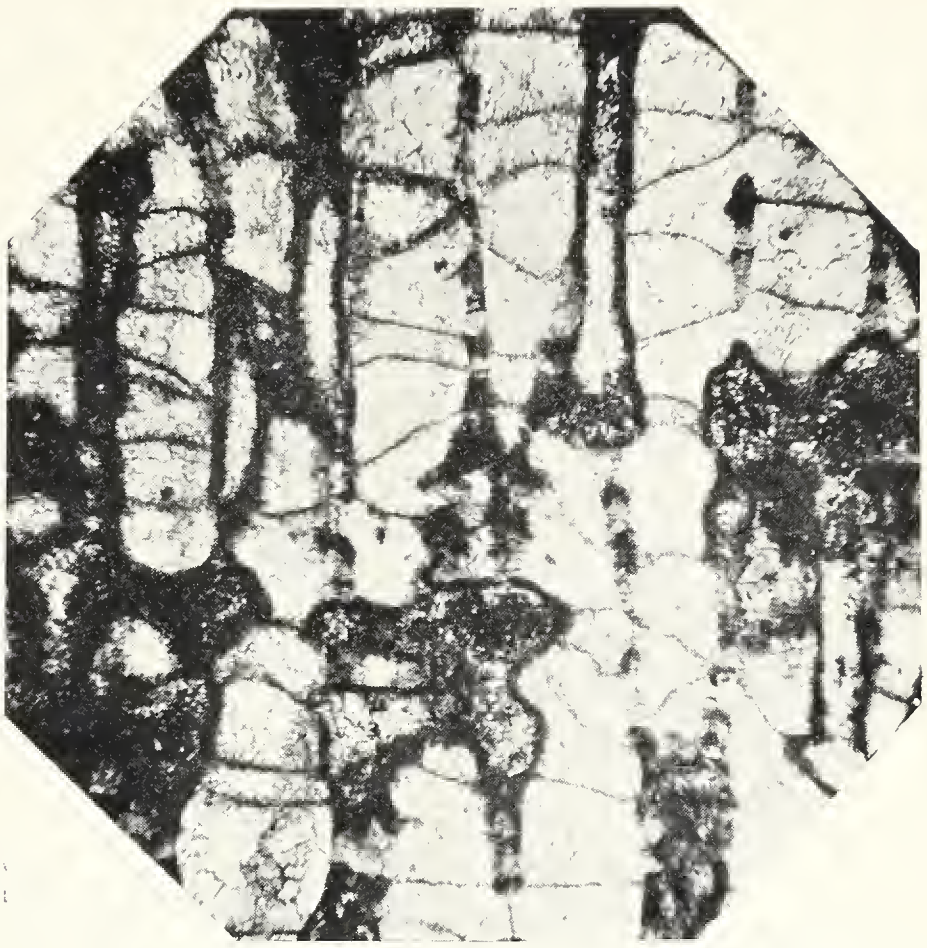


FIG. 17. × 15

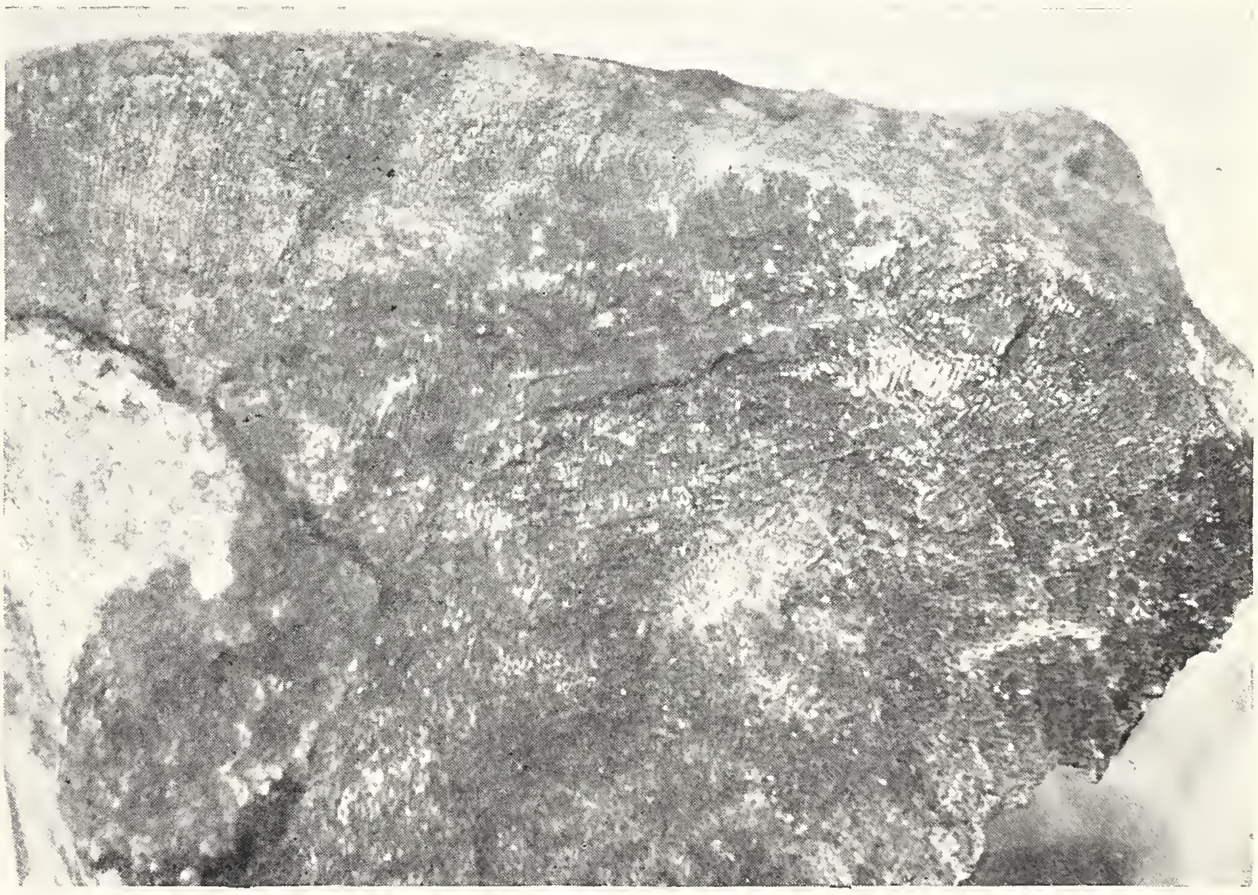


FIG. 18. Nat. size.

F.C., photomier

CANNAPORA AUSTRALIS SP. NOV.: TYERS RIVER, GIPPSLAND.

BRITISH MUSEUM
G D.
NATURAL HISTORY

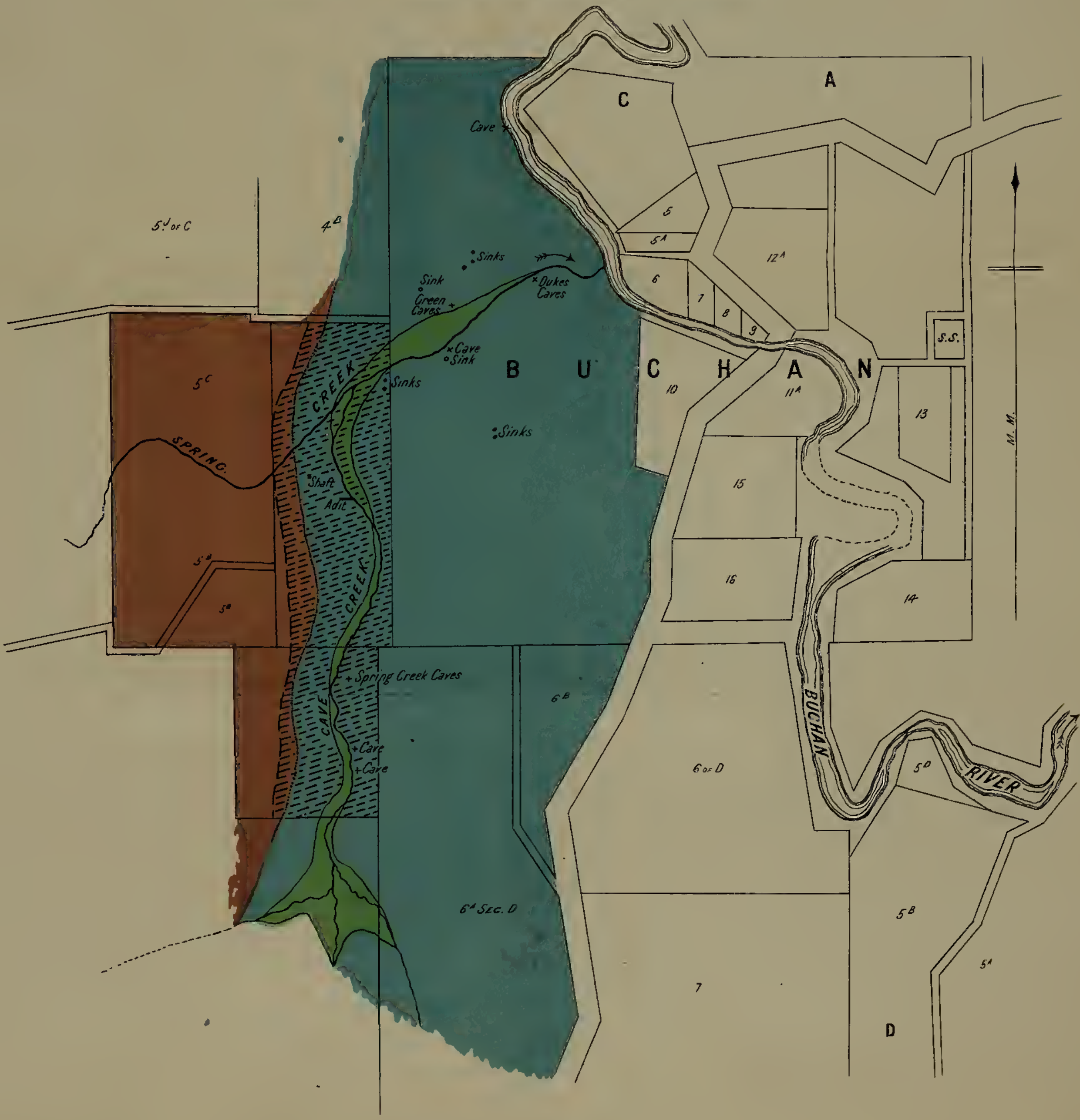
PLAN SHOWING
THE CAVES
NEAR BUCHAN TOWNSHIP.

SCALE – 20 chains to 1 inch.

REFERENCE.

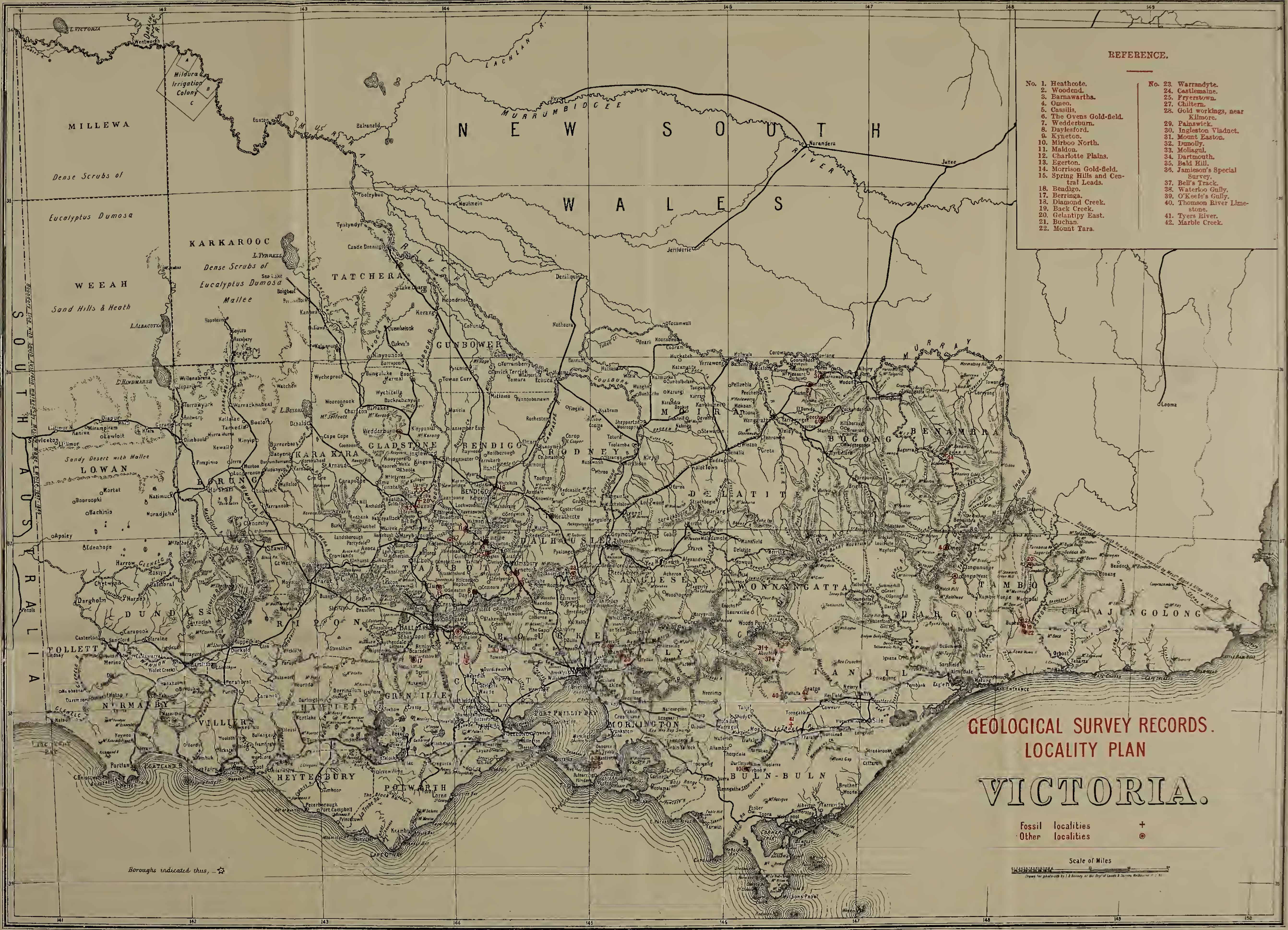
🟩 *Alluvium* 🟥 *Felsites* 🟦 *Limestone.*

Area recommended for reservation shewn thus ▨



G. BRITISH MUSEUM D.

G. BRITISH MUSEUM D.



REFERENCE.

No. 1. Heathcote.
2. Woodend.
3. Barnawartha.
4. Omeo.
5. Cassilis.
6. The Ovens Gold-field.
7. Wedderburn.
8. Daylesford.
9. Kyneton.
10. Mirboo North.
11. Maldon.
12. Charlotte Plains.
13. Egerton.
14. Morrison Gold-field.
15. Spring Hills and Central Leads.
16. Bendigo.
17. Berringa.
18. Diamond Creek.
19. Back Creek.
20. Gelantipy East.
21. Buchan.
22. Mount Tara.

No. 23. Warrandyte.
24. Castlemaine.
25. Fryerstown.
27. Chiltern.
28. Gold workings, near Kilmore.
29. Painswick.
30. Ingleston Viaduct.
31. Mount Easton.
32. Dunolly.
33. Moliagul.
34. Dartmouth.
35. Bald Hill.
36. Jamieson's Special Survey.
37. Bell's Track.
38. Waterloo Gully.
39. O'Keefe's Gully.
40. Thomson River Limestone.
41. Tyers River.
42. Marble Creek.

GEOLOGICAL SURVEY RECORDS.
LOCALITY PLAN

VICTORIA.

Fossil localities +
Other localities ◉

BRITISH MUSEUM
G D.
NATURAL HISTORY